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THE ORIGINAL MAGAZINE FOR
TRS-80™* OWNERS

H & E COMPUTRONICS INC.



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BITS & PIECES

Howard Y. Gosman

This has been an exciting month, and this issue contains some great information about new computers and software, which you'll read about here and in "The Crystal Ball." We have news and predictions about no less than FOUR new TRS-80 computers (!), the new Model 16 operating system, and a VERY important tip for anyone considering the purchase of a Model 16 (see "The Crystal Ball"). This month, we're even excited about a new APPLE computer—the LISA has finally been unveiled!

MULTITASKING ON DESKTOP COMPUTERS

One of the most important features of the newest computers will be multitasking capabilities. This feature, previously available only for users of large minicomputers and mainframe machines, allows a computer to literally do two (or more) tasks at the same time (or at least it appears to). The microprocessor (Central Processing Unit, or CPU)

of your computer can accomplish most tasks at fantastically high speeds, much faster than other parts of the system can keep up with it. Thus, in the ordinary operation of your microcomputer, the CPU spends most of its time waiting—it waits for the operator to input data, it waits for the printer to finish printing a line, it waits for the disk drive retrieve data from a file, etc. Since there's so much wasted "processor time" when running a computer, it is possible (with the right operating system) to have the processor two or more jobs at once. Whenever the processor has to wait for something while doing its primary task, it will then work on a secondary, or "background" task. For example, you use a word processor to type a long paper and edit it. When finished, you have the computer start printing the paper. While the printer is still printing, you can then start typing and editing a letter (a "foreground" task) while the computer continues to

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The purpose of the *H & E COMPUTRONICS MONTHLY NEWS MAGAZINE* is to provide and exchange information related to the care, use, and application of the TRS-80™ computer systems. H & E COMPUTRONICS, Inc. does not take any financial responsibility for errors in published materials. Users are advised to check and edit vital programs carefully.

The *H & E COMPUTRONICS MONTHLY NEWS MAGAZINE* encourages comments, questions, and suggestions. H & E COMPUTRONICS will pay contributors for articles and programs published in the magazine.

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THE CRYSTAL BALL

News and Rumors of Interest to TRS-80 Owners

ANOTHER NEW PORTABLE COMPUTER

According to the Wall Street Journal (January 28, 1983), Tandy Corporation is coming out with a Japanese-made, five-pound computer with a full-size keyboard, a screen that can display about a third of a page of text and built-in programs that enable the machine to perform such tasks as text editing and record-keeping the moment it is turned on. In addition, a plug-in package, much like a video-game cartridge, is being prepared to make it possible for the computer to do spreadsheet financial analysis. The price of the new computer is expected to be about \$700.

A few notes of clarification about portable computers: there are at least three different sizes of computers under the general classification of "portable" computers.

At the small end of the scale are the so-called "pocket" computers, or "handhelds" which look like big pocket calculators (too big for most pockets). These computers have a complete typewriter keyboard in miniature (which is too small to type on with both hands) and use a one-line LCD display to show text and numeric data.

At the large end of the scale are the OSBORNE-sized desktop portables, which weigh between twenty and thirty pounds and have disk drives and video screens built in. These machines are sometimes jokingly referred to as "sewing machine" computers because of their size, shape and weight. This type of computer generally does not have a built-in battery power supply. (Radio Shack will also soon release a portable version of the Model III computer, described in our last issue.)

In the middle are what are called "notebook" computers, which have full-size keyboards, but are about the size of a big three-ring notebook, and can be operated in your lap anywhere you go. These computers usually have an LCD display that will show about four lines of text at a time. Epson was the first company to heavily advertise a computer of this type, and several other companies (such as Hewlett-

Packard and Teleram) have also created very good machines.

The new Radio Shack computer is also a "notebook" computer, but unlike previous lap-sized portable computers, this new portable has full desktop-computer power. The new unit is called the Micro Executive Work Station. Tandy expects to sell 350,000 of them the first year.

The new computer will run programs written on other Radio Shack computers. It can also serve as an appointment book and an automatic telephone dialer and directory. In addition, it will also be able to place calls to electronic information services (such as The Source) and fetch and store such data as the latest prices of stocks.

The new Tandy computer seems to be far superior to the new Epson and HewlettMt-Packard computers (and its list price is lower too).

THE MODEL II HAS BEEN REPLACED

Tandy hasn't done a good job selling the TRS-80 Model 16, and they've replaced the Model II with the Model 12. The Model 12 actually sells for less money than the Model II, and has many more features (such as 80K of memory, which allows the operating system to reside in the top 16K and leaves the other 64K for your programs and data). There's nothing wrong with the Model 16, but it's a bit expensive for the present market.

Although it is an excellent computer, don't buy a Model 16. Buy a Model 12 instead. Then, when you're ready, upgrade the Model 12 to a Model 16. The price comes out to be just about the same as if you purchased a Model 16—but the Model 12 has a more advanced keyboard (including eight function keys), and when upgraded to 512K, the Model 12 will still have more empty slots available for future upgrades than the Model 16 has. If you upgrade the Model 12 to a Model 16, you'll have a better computer than the regular Model 16. So forget the Model 16 and the Model II. The Model 12 will give you more "byte" for your money.

continued on page 6



THE COMPUTER CONNECTION

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BITS AND PIECES

continued from page 6

wants to make an appointment. The computer operator, by touching a couple of keys, causes the letter to vanish, and the appointment schedule instantly appears. The operator quickly updates the schedule, says goodbye to the caller and hangs up. Then, just as quickly, the appointment schedule disappears, and the letter reappears, ready to be completed.

Advanced systems can allow users to do many tasks at the same time, interrupting one program to use another, and then returning to the first program—at the same point where you left it. The computer runs both programs at the same time. An exciting example of this type of computer is APPLE's new LISA computer, described below. After all this time, APPLE seems to have finally introduced a machine that even we die-hard TRS-80 lovers can get excited about!

In some cases, desktop systems will support more than one operator—the perfect example being Radio Shack's TRS-80 Model 16, which may be attached to two additional data terminals. Three operators can work at the same time on this system, reading data from the same disk files, sharing a printer, etc., all working with the same microprocessor (the 68000) in the Model 16. The biggest news about the Model 16 is that the Xenix operating system, which will allow multi-user operation, is now finally available (see below).

TRS-XENIX OPERATING SYSTEM

The TRS-80 Model 16 is finally ready to become one of the most powerful computers available for businesses, and all of Radio Shack's competitors are going to have trouble sleeping at night once people start installing these systems—no other company in the industry offers so much for so low a price, and if word gets around that the system is as versatile and easy to use as Radio Shack says, then every other company will be scrambling to develop multi-user systems. (SPECIAL NOTE: for a hot tip on why you should not buy a Model 16 now, see this month's "Crystal Ball" department, and read about

the new TRS-80 Model 12!)

The big news is that the real Model 16 operating system is now finally available. The TRS-XENIX operating system is based on Western Electric's UNIX system—which many people feel will be the new standard operating system for the future, eventually displacing CP/M. TRS-XENIX, created by Microsoft, is not just a "UNIX-like" operating system, it actually is UNIX, written for the TRS-80 Model 16. The really exciting big feature of this system (and the Model 16) is its multitasking abilities. The TRS-XENIX system will allow the connection of two of Radio Shack's DT-1 data terminals to the Model 16, so that three operators may simultaneously use the system for different tasks, all using the Model 16's microprocessor, and accessing the same files, all at the same time under the XENIX system. Originally, reports showed that a complete three-user system (consisting of a Model 16 with 256K of main memory, two DT-1 terminals and an 8.4 Megabyte Hard Disk drive) would cost about \$16,000. Now, Radio Shack is advertising this system for only \$10,391 (see the impressive full page ad on p. 21 of *The Wall Street Journal*, January 12). If you were to purchase a system with similar capabilities from IBM, it would cost more than \$30,000.

Multi-user capability is one feature that all computers will eventually have to provide to stay competitive in selling small business computers. Here's Radio Shack's scenario: "Think of the possibilities. Your sales department could check inventory levels while someone in accounting updates your general ledger—at the same time someone else is working on payroll!" (And they all work using files on the same hard disk drive.) "All multi-user programs for accounting and inventory will be available in the coming weeks . . . plan on seeing program for word processing, electronic filing, and . . . a new, second generation electronic spreadsheet from Microsoft . . . the ultimate tool for forecasting and modeling. It's so good, it was recently selected as *InfoWorld* magazine's 1982 Software Product of the Year."

A free brochure on the TRS-XENIX system and the Model 16 is available upon request from Radio Shack, Dept. 83-A-662, 1300 One

Tandy Center, Fort Worth, Texas 76102.

APPLE INTRODUCES THE LISA

Apple's most ambitious computer has finally been released, and the entire industry anxiously waits to see what the response of consumers will be. The Lisa, by far the most expensive Apple at just under \$10,000, has features associated with even more expensive computers.

Using an approach similar to the Xerox Star System or other computers which use variations of the "Smalltalk" language, the Lisa uses very high-resolution graphics to create a picture of a desktop on screen, with symbols (or "icons") that represent file folders, disk drives, a wastebasket and other familiar office equipment. The operator uses a "mouse", which is a handheld cursor-movement device, to place a cursor on one of the symbols and select a particular operation. For example, you can move a cursor to indicate a file folder, and a corresponding data file is then opened for your access.

Information from many different sources is mixed on screen all at the same time with "windows"—groups of simultaneous overlapping displays which can be opened and moved around on screen. An important feature of this kind of system is that numeric data, graphics and text can be passed back and forth between many different types of programs—for instance, data from a spreadsheet program can be used to generate graphs which can then be used by a word processing program. Many people predict that this type of system will be the new "wave of the future" in small computers, introducing a new era in which people can deal with computers in more human terms, instead of having to learn all kinds of special codes to put computers through their paces.

The Lisa includes a 12-inch high-resolution black and white monitor (720 by 364 pixels), one Megabyte (!) of main memory (that's 1000K of RAM!), two 1.7 Megabyte floppy diskette drives, a built-in 5 Megabyte hard disk drive, a typewriter-style keyboard with 10-key numeric keypad, and a computer mouse.

One reason for the high price tag

is the inclusion of a lot of software with the Lisa package (everyone is learning something from Osborne, the first company to package standard software with every computer sold). With the Lisa comes LisaCalc (a VisiCalc-like spreadsheet), LisaWrite (word processor), LisaGraph (to graph data from LisaCalc), LisaDraw (a graphics package), LisaList (a database system), and LisaProject (a project management system). The Lisa will also run the BASIC, COBOL and PASCAL languages and will be able to run Microsoft's new XENIX multi-tasking operating system.

MAKING MONEY WITH YOUR COMPUTER

Anyone who's ever wanted to start their own part-time business will appreciate this encouraging and realistic look at how a personal computer can become the basis of a successful home money-making enterprise. The authors give 33 innovative computer ideas ranging from lost pet services to roommate referrals, from direct mail advertising to personal investment analysis, from a unit comparison shopping service to novelty publications, from a computerized babysitting listing to church record-keeping, from biorhythm charts to computer music. And that's just the beginning for an imaginative self-starter.

We have seen at least three or four of these "using a computer to make money books" over the past several years. This seems to be the best of them and it is worthwhile reading if that's what you are setting out to do.

There are plenty of helpful hints on advertising services—including tips on how to write response-pulling ad copy, how to handle newspaper advertising, and tips on developing and keeping customers.

Making Money With Your Microcomputer was written by Robert J. Traister and Rich Ingram and published by TAB BOOKS INC., Blue Ridge Summit PA 17214 (717) 794-2191. The price is \$7.95. (It's not available through H & E Computronics, Inc. but it is available through local computer book stores or by calling the telephone number above)

continued on page 10

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BITS AND PIECES
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ELECTRONIC ENCYCLOPEDIA

A computerized version of the *World Book Encyclopedia* is now available through the CompuServe Information Service. This project is intended to test the feasibility of this type of service, and enables computer users to search through a listing of more than 31,000 subject entries and retrieve any part of the ten-million word text of the encyclopedia. Subscribers can select articles from a menu display that shows all articles whose titles begin with a key word you specify. A News Flashback feature covers current events and steers the reader to related encyclopedia articles, and a challenge feature tests the user's awareness of facts covered in various articles. The encyclopedia will be updated quarterly to insure that all information is current.

AUTOMATED ELECTRONIC MAIL

A new communications utility is available that has some of the most advanced features ever seen in a microcomputer terminal program. The ACEMAIL system was designed to support the auto-dial/auto-answer features of the Hayes Stack Smartmodem, and is capable of receiving or making calls, and sending or receiving data completely unattended! With the ACEMAIL system, it is possible to program your computer to place a call at any time and date (redialing as many times as necessary to get on line), and once logged on, it can send or receive whatever files you have programmed it to transfer—all automatically.

A disk file can be created to store commands for a long list of outgoing calls, including the date, time, phone number, transmission speed, prompt delay and names of files to be transmitted. When the proper time comes, the program refers to the disk file, places the call, and makes the transmission.

The ACEMAIL system is presently available for TRS-80 Models I and III equipped with 300 or 1200 baud Smartmodems, and the Smart-

modems themselves are available from the same source. The ACEMAIL 1200 Software costs \$119; the ACEMAIL 300 Software is priced at \$79. The Hayes Stack Smartmodem, 300 and 1200 baud models, are available for \$239 and \$619 respectively. The ACEMAIL system was created by ACE Computer Products of Florida, Inc., 1640 N.W. 3rd Street, Deerfield Beach, FL 33441; voice phone: (305) 427-1257; data phone: (305) 427-6300.

SMALL BUSINESS MANAGEMENT SYSTEM

Howe Software has released a SMALL BUSINESS MANAGEMENT SYSTEM designed to provide everything needed to manage a small business on a microcomputer. The system provides for order entry, prints invoices (on plain paper or preprinted forms) and mailing labels, allows recall of invoices from past orders, and keeps track of inventory, with a complete list of all products sold by product type and retail value. Bookkeeping features include a complete general ledger with records of income and expenses by categories.

A complete "installation package" customizes the program for the needs of each business. You define (or update at any time) product and price list (with a maximum of 1000 products) and build a chart of income and expense categories. Other custom items include sales tax rates, shipping and handling charges, automatic invoice numbering, and provision for price discounting.

The system is available for the TRS-80 Models I and III (priced at \$350), and also for the TRS-80 Model II, IBM Personal Computer, Osborne-1, or any CP/M computer with 8-inch disk drives (all priced at \$400). The system requires an 80 (or more) column printer with 10 character-per-inch print, and it will work on hard disk drives. For more information, contact Howe Software, 14 Lexington Road, New City, NY 10956; (914) 634-1821. (This program can also be ordered directly from H & E Computronics at 800-431-2818.) ■

PROGRAM PREVIEWS

A. A. Wicks

This Month: ARRANGER

Whenever I am looking for a program to review that may be of interest to our readers, I sometimes scan the back reaches of various computer publications. This is the part of the magazine where some of the typefaces are so small I feel that I am in training to read the Bible on the head of a pin. At these times I look for the small two-column ads, placed mostly by companies or individuals who are perhaps not in a position to place \$6000-per-page four-color advertisements. I do this for two reasons—perhaps there is a gem to be found (among rocks); and, it would be nice if a worthy program were able to receive whatever benefits an exposure by my review might offer.

On one of these "back country" searches recently, I found "ARRANGER," a disk file indexing program offered by Triple-D Software of Layton, Utah—a small town just north of Salt Lake City. (Since seeing Triple-D's advertising in another magazine, I note that they are also advertising in this one.)

ARRANGER cannot unequivocally be classified as a "gem," but far from being a "rock" it is an exceptionally fine program for the purpose for which it was designed. I had some initial problems in using this program, but, as it turned out, these stemmed from my interpretation of unclear documentation rather than from any program fault or deficiency. Once these problems were out of the way, I had no further difficulties, and was impressed with the smoothness and impressive operation of the program. Incidentally, the cooperation of the people at Triple-D was outstanding in clarifying my problem, they were interested, concerned, and cooperative, and quickly supplied me with another disk (which turned out to be unnecessary).

INITIATION

ARRANGER is started by placing the ARRANGER disk in Drive 0 and resetting for a new "boot-up." No provision is made for a backup of the program disk itself, and the original disk has its own operating

system. When I inquired regarding what DOS this might be, I was advised it was a Triple-D DOS, and ARRANGER is self-booting. I did not pursue this further, it works and these reviews are not particularly concerned with the inner workings of a program, except possibly as a passing interest. However, as the program would not back up, and would not provide a Directory from DOSPLUS, I assume the DOS is proprietary. This lack of a backup capability concerns me—somehow I believe a backed up disk is more comfortable to work with; but the program originators must be the ones to determine how useful this might be versus the moral issue of bootlegging possibilities. Later, there will be a description of the function "Backup" as it applies to ARRANGER.

INDEX PREPARATION

Prior to running and assembling a disk directory with ARRANGER, you must decide how you propose to format this directory, by naming your disks in accordance with some plan acceptable to ARRANGER. The name applies to the disk itself—not the programs thereon. The name will replace the current name. For example, the name may be "TRSDOS" before renaming. Afterwards, this could be a number, or any other name up to eight characters long. For instance, I have perhaps 200 disks, and prefer to number them physically (regardless of their data name), using press-on labels. But prior to ARRANGER, they carried disk data names as above—TRSDOS, NEWDOS, etc. With ARRANGER, it was an easy task to give the disks the same "electrical" name (which is actually a number in my case), as the physical one. Others may prefer to name their disks by classification, perhaps, such as GAME51, UTILITY4, and so on. Once the method of indexing is determined, you may begin renaming your disks, using the Rename command. This is selected from a menu following

continued on page 12

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the old name will remain in the file (but not on the disk), the ARRANGER index will still show the old name. This is useful if you have added a new disk name not wanted. Rename will correct the disk name and the Index.

Each of the menu commands may result in certain Error Messages, if the situation warrants. With Rename, one that can occur (as noted above), is "Disk Name Already Exists," which, if allowed will result in two identical names on file. Another error message will occur if an attempt is made to rename a write-protected disk, or an unrecognized DOS is encountered. The latter is not likely to occur, inasmuch as ARRANGER recognizes nine different DOS.

The preceding Renaming function is the "work" part of using ARRANGER. Once this is out of the way, the remaining menu functions are short and easy, and provide beneficial results.

OPERATION

The Add command adds the disk records to ARRANGER. That is, the disk name and all program file names on each disk are added with this command. Up to 45 names per disk are allowed, and in addition, pertinent information such as Free Grans, created and updated dates, number of files, whether a System or Data disk, density and DOS type, are all recorded for later information. All single density disks are recorded as "NEWDOS," although you may have no NEWDOS disks! System and Invisible files are not added. I like this, as otherwise you could have dozens of the same program name in the final index.

Add operates similarly to Rename. You are prompted to insert a disk and press <ENTER>. Once the directory is found and read in to memory, it is displayed and added to the ARRANGER file. This function too, has error messages. One of these, "Maximum Capacity Reached," occurs when 240 disks have been added (200 in single density), which is the maximum quantity. This is not restrictive to anyone wishing to extend beyond this number of disks, as long as this is planned in advance for your system of indexing. For example, your index numbering system could be such as 001-200 for the first series, and 201-400 for the



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PROGRAM PREVIEW

continued from page 11

program initialization and date entry, by entering R. (The commands appear on the menu as <R>ename, etc., with the first letter providing the shortcut function entry. The Rename command is followed by a screen request to insert a disk and press <ENTER>. The old name is then displayed and a new one requested, which you now type in, and immediately the disk is rewritten with the new name. All this takes only a few seconds—less than the time to describe it. Proceeding in this way, a rapid renaming of all disks is accomplished easily. If your disks are physically distributed so that you can pick them up and insert them quickly, dozens of disks can be processed in 10 or 15 minutes.

In using Rename, if the name was previously on file (this is when you have ARRANGER established as your system index), you will be asked if you want the change stored in ARRANGER. If the reply is affirmative, the old name is deleted and the new name entered on the disk. If you should reply in the negative,

second. Another valuable flag is "Diskette (..name..) Already on File," which prevents duplication of this type.

If at any time, you may wish to update an ARRANGER index, that word, Update, will do this. This would be desirable, for instance, if new files have been added to a disk, or purged, etc. This function too, is interactive with a screen dialog.

We now come to some of the useful outputs of ARRANGER. Using View, all information about a disk is displayed, except the file names. Nine lines of information are provided, and to view more, the Up and Down arrows will scroll the display. The Print (alphabetical list), command allows you to view the file name information not provided with the preceding command. There are several interesting and useful options available here. One of these allows the output to be either viewed or printed. Also, a Sort, other than the alphabetical listing, may be requested. For example, if you only wish to see CMD-type files, this may be requested. When using a video output, you may use the arrow keys once more to scroll through the ARRANGER index. One nice feature is that the filenames are in rows on the screen, whereas the printer output is in three columns. If there are more than 250 filenames in memory, pressing Clear will continue the sort.

The Find command will search for any file name chosen. In fact, if you cannot recall the full name, it will search based upon the initial part of the file name, if you precede the portion of the name you enter with a question mark. This too, permits the locating of all file names that may start with a certain letter grouping. For example, you might have a number of biorhythm programs, all starting with "bio" that would be displayed when searched for with the command Find—?bio. Once located, the monitor will display the file name and the disk name (or number if "name" is a number), on which the program appears. As with the other commands, the screen may be scrolled if necessary.

The Locate command may sound as if it were another Find com-

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PROGRAM PREVIEWS

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mand, and in a sense it is. However, in this case Locate identifies disks in the total index system that have a specified amount of free space on them. When you specify <L>, the screen dialog requests the minimum amount of free space that it is desired to locate, in granules. Suppose you state "20" as your answer. A list of all disk names that qualify will be displayed, showing the number of granules each has on it. Of course, all disks with more than 20 available granules will be shown, but none will be shown that has less. This is an attractive feature, particularly when disk space is getting tight and you are scratching for a bit of space. It also permits full utilization of disk space.

The Scan command allows you to look through the directories of all disks on ARRANGER. All information relating to a disk will be displayed. Scrolling is controlled as with the other commands, by use of the arrow keys. In looking for some particular name while in the Scan mode, you have the option of starting at some selected name, rather than having to scan the entire file.

We now come to the Backup command. Earlier I said it was not possible to backup ARRANGER. True—when we discuss backup in the usual connotation. But in the ARRANGER sense, backup may be accomplished at any time ten or more disk records have been added to ARRANGER. Then, what occurs is that the ARRANGER and the disk index is backed up to another disk. You now have a backup from which we assume ARRANGER and the index records cannot be separated. I queried the authors about this rather unusual approach, and was told that they considered this "a passive means of protecting the program." I suppose it does accomplish that, and it does not handicap the owner of the program—but it would be a real annoyance to anyone receiving an unauthorized copy (together with someone else's index on it).

SPECIAL OPTIONS

There are some operating niceties with ARRANGER that are well worth mentioning. If you have used one of the menu selections, pressing any

key will return the program to the previous selection. This markedly speeds up such functions as adding disks to the records, etc. If you press the Break key in response to a screen query, you are returned to the menu. Users having three or four disk drives may select these drives directly while in screen dialog. Also, there are several options available to use should difficulties occur because of an electrically damaged disk, for example. A lower-case driver is built in to ARRANGER, and Model I systems have keyboard debouncer software installed. No problems should occur with Model I units that have been modified by Radio Shack, and operation with the Radio Shack or other manufacturer's doublers installed, is trouble-free.

Earlier, mention was made of the Manual mode of ARRANGER. In the Manual mode, it is necessary that you type in the disk names during Add or Update. This could happen if you did not want to Rename all of your disks, but would really slow up information entry. There is a "toggle" command available that allows you to select between Manual and Automatic entry. The latter mode is as described for all of the functions previously listed.

INSTRUCTION SHEET

The instructions that accompany ARRANGER cannot be classified as a manual as they comprise only both sides of a sheet of light card stock 8 1/2 by 14 inches in size. However, this text is formatted to the equivalent of six pages of standard printed pages reduced to eight-point type size. This is undoubtedly small (about 1/8th inch), but nevertheless is in a clear, easy-to-read typeset font, with Bold section headings.

The composition of this instruction sheet is another matter. It is rife with spelling errors (and a few typographical ones). There is really no excuse for errors such as these, and I would urge the authors to obtain the services of a High School English teacher to look this material over before the next reprinting. The instructions themselves are confusing in places, and one important item that has been overlooked is an Introduction—something, in this

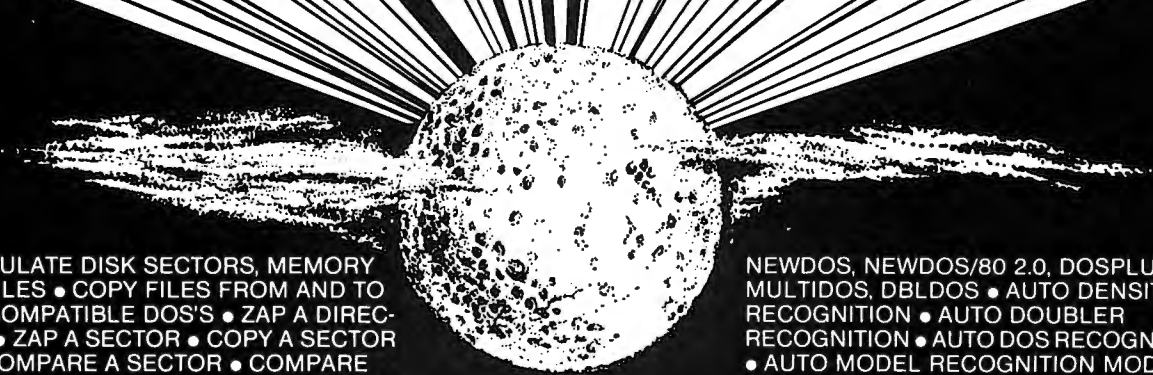
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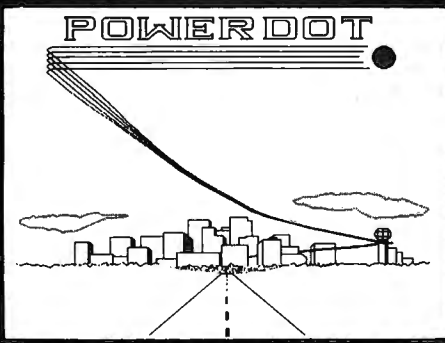
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SORTING IT OUT

Arne Rohde

1. Introduction

In the series of articles on sorting and searching which have appeared in *Computronics*, we have seen a number of different algorithms which can be used to sort an array into a particular sequence. These algorithms have not been programmed as stand-alone programs, but as routines which could be used in other programs. Normally sorting programs are not written to show the sorting process as it occurs, but the TRS-80 with its memory mapped video display is suited to a real-time demonstration of sorting techniques.

The program presented here is based on the sorting algorithms presented in the series "Array of hope for BASIC programmers," and the technique was inspired by a sorting demonstration program contained on the MMSForth disk (MMSForth version 1.9). The sorting demonstration on the Forth disk contains several sorting routines, where the data being sorted are single byte values contained in the video display area.

2. The Sorting Program

The sorting demonstration program consists of two main sections. The first section contains the code to generate a random array of single-byte values which is to be sorted. The array is kept in memory, to allow the same set of data to be used for each of the sorting methods.

The values generated are in the range from 20H to 0BFH, in other words all the printable ASCII characters and the TRS-80 graphic characters. On Model I computers without a lower case modification, lower case alphabetical characters will not be shown, as they are converted to upper case when they are stored in the video RAM.

The menu allows the selection of each of the sorting routines, or the generation of a new random set of data. The main portion of the program consists of the seven different sorting routines. Each routine can sort up to 960 elements, leaving the bottom line on the screen free for displaying text during the sorting process.

When a sorting algorithm has been chosen, the number of elements to be sorted must be entered. For all except the insertion sort the screen is then filled with the randomly generated elements to be sorted, and the sorting process then begins.

The program can be used for purposes other than demonstrating various sorting algorithms. Since the sorting routines can be programmed in different programming languages, they can also be used to give an indication of the relative execution speed of various languages and compilers. The comparisons are perhaps of limited value, since all manipulations are performed on integer values.

The program has been run in the version shown under several compilers, and some of the algorithms have been programmed in other languages.

3. Execution Timings

All the timings have been performed on a Model I TRS-80 at its standard speed, running under New-

dos/80 Version 2 with interrupts enabled. The timings may be improved slightly by disabling interrupts, and possibly also by running under the ROM BASIC without any DOS present.

On the Model III and on any other computers where wait states are introduced during screen scanning, these waits should be disabled. On the Model III, port 236, bit 5 is used to control the video wait function. If bit 5 is set to zero, then the video does not generate waits, if set to 1 then waits will be generated when accessing the video RAM area. Thus the instruction OUT 236,0 could be inserted in the program on the Model III to select no video wait, 64 character mode, and disables the alternate character set.

The timings have been performed using a stopwatch instead of the internal timer, and several of the times are averaged over more than one execution. Because of the slowness of interpreted BASIC, only a few times have been recorded for comparison purposes.

Each sort routine used the maximum 960 elements for the timing runs. The same array was used for the timings of the various algorithms used with each compiler.

The execution speed of some sorting algorithms are more dependent than others on the number of duplicates in the data to be sorted. With 960 characters to be sorted and only 160 different characters available there must be many duplicates. The timings should therefore not be considered as absolute values, but rather as guides to the relative speeds of the algorithms and compilers.

In the languages where the random generation function is not directly available, the random numbers have been chosen by filling the array with a portion of the ROM memory. This gives 256 different characters values in the array. This will have a slight influence on the sort timings for these languages. The languages where this technique have been used are Pascal-80, Fortran and assembler.

4. Interpreted BASIC

As could be expected, the interpreted BASIC version of the program is the slowest. The program has been written with spaces between words, and with a few comments in appropriate places, and this also affects the execution speed negatively.

The program was run with the BASIC supplied with Newdos/80 Version 2, and because of the lengthy execution times only a few of the sorting algorithms have been timed.

The times for interpreted BASIC were as follows:

Sorting method	Time in seconds for 960 elements
Insertion	7009
Bubble	10260
Shuttle	8755
Shell	438
Quicksort with insertion	391

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PROGRAM PREVIEWs

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case, that would tell the reader what the program is for, what it does, and how it does it, succinctly, before the specific details are given. As it is, the instructions start out by telling in three short sentences how to start the program running, and then there is a discourse on how numbers (for disk names), should be entered with and without leading zeros. In general, the instructions continue in this disjointed manner, with no practical grouping of the information. On the scale of 1 to 10 as provided in these reviews, this documentation rates a 4.

As critical as I am of the documentation, the exact opposite must be said of the program operation. Every function operates cleanly, and with phenomenal speed. It is a pleasure to use a program in which machine language is directly at work, and this is obviously reflected in the alacrity of searches, sorts, and screen listings. As the speed of operation was amply demonstrated for me with a few hundred file names, I can easily accept the producer's claim that ARRANGER will sort 1500 file names in just 40 seconds, and find one program name from the same number of names in 30 seconds or less. Some error trapping would be desirable—I lost all that I had entered at one point with a "lock-up" of the computer when I inadvertently addressed a drive that had no disk in it. ARRANGER does not include an "information line" as some disk index programs do; this may or may not be important to the user.

PROGRAM BACKGROUND

According to Triple-D, ARRANGER was three years in development. Rich Foy wrote the first version in BASIC for personal use. Then Dan Foy (at the time, 16 years old), assumed the task of writing the program in machine code as a challenge to his capabilities. He did this throughout his Junior and Senior years of High School before the program evolved satisfactorily in July 1982. Dick, Dave and Dan Foy are Triple-D (get it?).

The program is now entirely in

machine code, and its source listing requires about 160K, and it requires 17 minutes to assemble it into a CMD file. The program makes only two calls to ROM—one for delay and the other for a keyboard driver. When a disk is updated, the entire file is re-written, and each time the program names are sorted, it is a total sort. Further development is taking place on the sort portion of the program, and tentative experiments have put it at about one-half again of its present rate of speed, which even now, as has been mentioned, is exceedingly fast.

SUMMARY EVALUATION

ARRANGER is a useful and attractively priced disk index program. The broad array of information gathering functions, and the alphabetized printout will make it a welcome addition to anyone who has large disk records to maintain, and wishes to handle these expeditiously and accurately, with an excellent printout of the results.

ARRANGER—Model I, Model III (specify), 32K, 1-drive min. Triple-D Software, P.O. Box 642, Layton, UT 84801—\$29.95

A. A. Wicks
30646 Rigger Road
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LETTERS TO THE EDITOR

Errors in TRSDOS Patches

I just received my February issue of *Computronics* and I am sorry to report that you made four errors in listing my patches (page 60), and I would appreciate it if you would inform your readers. I am also going to explain to them how to correct the errors if they were unfortunate enough to have entered them.

#4 should be:

PATCH *6 (ADD=5850,
FIND=3A62,CHG=BF5F).

Users would have no problem with this one, since the patch would not be able to "find" the erroneous values.

#12 should be:

PATCH *5 (ADD=4F04,
FIND=D0,CHG=C9).

Users who erroneously entered this

patch can fix it by patching as follows:

PATCH *5 (ADD=4F04,FIND=D9,
CHG=C9).

#17 should be:

PATCH *4 (ADD=4E28,FIND=20,
CHG=18).

If users were successful in making this patch, two patches will be necessary to correct it. Since the address is wrong for the routine as published, it may not have worked when users tried to enter it. If they got a STRING NOT FOUND error, they merely will have to enter the correct patch. Otherwise:

PATCH *5 (ADD=4E28,FIND=18,
CHG=20).

Then enter the correct patch #17.

#18 should be:

PATCH *0 (ADD=4EA9,FIND=CA,
CHG=C3).

The correction routine is the same as that for #17. If the patch WAS entered and accepted, correct it by

PATCH *5 (ADD=4EA9,FIND=C3,
CHG=CA)

and then enter the correct patch #18.

I know I don't need to point out that patches entered incorrectly can wreak havoc with a user's DOS. Please get these corrections to your readers in the next issue.

Jerome I. Weintraub
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SORTING IT OUT

continued from page 16

The bubble sort is by far the slowest, the time for 960 elements corresponds to almost 3 hours! The quicksort is more than 25 times faster with the chosen data, and this factor increases with increasing numbers of elements to be sorted. The insertion sort which is actually simpler to code than the more popular bubble sort is about 30 percent faster, but still about 18 times slower than quicksort.

The difference in time between the Shell sort and quicksort is not very great, the fastest execution of Shellsort being actually faster than the slowest execution of quicksort. The difference can be expected to be greater when more elements are to be sorted, but with the numbers chosen here there is very little difference in speed. Quicksort could possibly be speeded up by a better selection of the pivot element when each portion is being sorted.

Another problem with interpreted BASIC is that the execution speed of a GOTO or GOSUB is dependent on the location of the destination line relative to the source line, or its location relative to the start of the program. GOTO and GOSUB near the beginning of the program will be faster than near the end of the program. Quicksort is therefore at a disadvantage in this case, since it is positioned near the end of the program.

Variables in a BASIC program are allocated in memory in the sequence in which they are encountered when the program is executed. The variables which are used first will be referenced faster than variables which are allocated later, since the search for a variable name is a sequential search. Thus the execution speed of a sort algorithm will be faster if it is executed first, rather than being executed after all the others have been executed; since each of them allocate new variables.

BASIC program execution speed can be improved by removing all spaces and remark statements, but at the cost of making the programs almost illegible. The program size will, of course, also be smaller. Several compress programs are available to remove unnecessary spaces from BASIC programs.

5. Compressed-interpreted-BASIC

Some time ago I wrote a compress program which does more than remove unnecessary spaces and comment lines from BASIC programs. Lines are also combined into longer lines when they do not contain conditional statements. Thus the lines

```
510 AE = AM + 1
520 PLE = AE - 2
```

could be combined into a single line if line 520 is un-referenced, whereas the lines

```
1290 IF JH>IH THEN 1140
1300 JL = JH - 1:AW = PEEK(JH)
```

cannot directly be combined even if line 1300 is un-referenced. However, they can be combined with the addition of an ELSE between the two lines.

The compress program also removes the effect of destination line location on GOTO and GOSUB statements, since these are recoded to give an indirect jump directly to the destination line. Thus all GOTO and GOSUB statements will require the same execution

time, irrespective of their location and the location of the destination line.

Only two of the sorting algorithms were executed with the compressed program, but the times give an indication of the savings possible by simple means. The times were as follows:

Sorting method	Time in seconds for 960 elements
Shell	344
Quicksort with insertion	268

The difference between the Shell sort and the quicksort has become more pronounced, which seems to indicate that the quicksort in normal BASIC is being slowed down by the GOTO statements, since the program lines for this sort are located nearest the end of the program.

Compression and direct GOTO and GOSUB are two methods for speeding up execution of BASIC programs. Another method is compilation with one of the compilers available. The Microsoft compiler was one of the first available, but also one of the most expensive, so it does not exist in my program collection. ACCEL2 from Southern Software in England was one of the first compilers to appear at a reasonable price, and it has since been followed by ACCEL3.

6. ACCEL2 and ACCEL3

The ACCEL2 compiler is available in the USA from Allan Gelder in San Francisco for \$99.95. It is a rewrite of ACCEL2 with a number of extra features. The compiler is resident in memory together with the program to be compiled, and the program is compiled directly to memory, replacing the original BASIC source.

The compilation process is faster in ACCEL3 than in ACCEL2, and took less than 5 seconds for the sort demonstration program. The compiled program was about the same size as the source, but to this must be added the portion of the compiler which must be resident at all times.

There are very few restrictions on programs to be compiled with ACCEL3 compared to interpreted BASIC, but not all statements are compiled. The uncompiled statements will still be executed, but they will be interpreted. Thus there is not much to be gained from compiling programs using only double precision real arithmetic, whereas programs using integer arithmetic can be speeded up considerably, as the sorting demonstration shows.

The times for ACCEL2 are slightly faster in several cases, but at the inconvenience of slower compilation, larger compiled programs, and more restrictions on the allowable BASIC program constructs. The program as shown was compiled with both ACCEL2 and ACCEL3 without any changes.

The sorting times were as follows

Sorting method	Time in seconds for 960 elements	
	ACCEL2	ACCEL3
Insertion	77.8	74.4
Selection	157.1	163.7
Bubble	196.8	231.1
Sifting	85.4	80.1
Shuttle	146.9	165.7
Shell	6.0	6.9
Quicksort with insertion	5.6	4.8

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SORTING IT OUT

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The improvements compared to interpreted BASIC are very impressive, ranging from about 50 times to about 90 times faster. It is fascinating to watch a screen being filled with random characters which are then sorted within about 5 seconds.

The disadvantage of ACCEL3 compared to other compilers is that the disk BASIC interpreter must be present while the program is being executed, as must a portion of the compiler resident in high memory. The compiled program can be saved to a disk file, but it cannot be loaded and executed in the same way as assembly language programs. A compiler called ZBASIC is available with these features.

7. ZBASIC 2.2

ZBASIC is a BASIC compiler written by Andrew Garipey and sold by Simutek in Tucson, AZ. The disk version of the program costs \$89.95, and a tape version is available at a slightly lower price.

As mentioned above, ZBASIC has a few advantages compared to ACCEL3, but it certainly also has a number of disadvantages. Actually ZBASIC can be considered a new language, except for programs using only integer arithmetic. Most programs cannot be written and tested in interpreted BASIC and then compiled for increased speed, as is the case with ACCEL3. Instead, the programs must be written in the ZBASIC dialect, and compiled each time a correction has been made.

The process is simplified for smaller programs since the source program, the compiler, and the compiled program can be resident in memory at the same time. For larger programs the revised source program must be saved to disk, the compiled program saved to disk, control passed to the DOS, and the program loaded and executed from disk. This is a rather slow process, even if the compilation is relatively fast, being only a few seconds for the demonstration program.

The difference between BASIC and ZBASIC can best be illustrated with a few examples. In the ZBASIC dialect the commands AUTO and EDIT are used to generate a tone on the cassette port, CDBL and CINT will search for a particular byte in memory, DELETE gives a delay of a specified number of milliseconds, ERR and ERL move portions of memory, and FN provides the remainder after an integer division. There are other, smaller, differences. For example all string data in DATA statements must be enclosed in quotes, and FOR loops cannot specify a variable as STEP.

The demonstration program required a few minor changes to be compiled with ZBASIC. The Shell sort FOR loop starting at line 950 contains a variable as STEP, and this had to be changed for ZBASIC. The FOR statement is changed to an assignment (FI = I), and the NEXT statement in line 1010 is changed to an addition and a conditional GOTO.

One of the main advantages of ZBASIC is the execution speed for integer arithmetic, as can be seen from the following times for the sorting algorithms.

(see top of next column)

Sorting method	Time in seconds for 960 elements
Insertion	68.2
Selection	90.7
Bubble	127.8
Sifting	65.8
Shuttle	97.5
Shell	5.3
Quicksort with insertion	2.9

8. Forth

The MMSForth system from Miller Microcomputer Services of Natick, MASS contains a sorting demonstration which inspired the BASIC program reproduced here. The demonstration contains four sorting algorithms, but there are two variants of the quicksort. One of them contains embedded assembly language code for improving the execution speed.

The version of MMSForth used was 1.9 which has been superseded by version 2.0 some time ago, but since I have not upgraded to 2.0 I have not been able to compare the times for the later version.

One difference between the Forth version and the other versions of the program is that the random values are produced as they are moved to the screen. If the random values were generated first, the times for the sorting methods would be reduced by about 4 to 5 seconds each. No attempt has been made to modify the original demonstration program, either to move the data generation or to optimize the sorts.

The times for the four sorting methods were as follows:

Sorting method	Time in seconds for 960 elements
Insertion	379.7
Selection	262.8
Shell	29.5
Quicksort	15.1
Quicksort with assembler	10.4

There is an apparent anomaly between the relative times for insertion sorting and selection sorting, but this is apparently due to an inefficient coding of the insertion sort in the Forth demonstration, and perhaps a more efficient coding of the selection sort. I have not attempted to analyze the algorithms in detail, since there is some truth in the statement that Forth is a WOL (Write Only Language).

Compared to interpreted BASIC the execution times for Forth are impressive, but they cannot compete with the times for the two compiled versions of BASIC. Only the quicksort implementation with embedded assembler code is comparable in speed to the ACCEL3 and ZBASIC versions.

9. Pascal-80

One of my friends who owns a TRS-80 has the Ramware version of Pascal-80. A later, improved version is now sold by New Classics Software of Denville, NJ for \$99. The Ramware version was used to code 3 of the sort algorithms.

The Pascal-80 implementation is a semi-compiler,

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SORTING IT OUT

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since the source code is compiled to an intermediate code, usually known as P-code. The P-code is then interpreted when the program is executed. In theory, and sometimes also in practice, the processor independent P-code can be moved from one processor to another, by merely coding the interpreter program for the new processor. This is not the intention in Pascal-80 which presumably uses P-code because it is simpler to compile a program to P-code than to machine code.

The disadvantage of compiling to P-code is that the code must be interpreted, and although it is much faster than interpreted BASIC, it is still considerably slower than machine language.

The times for the three sort algorithms coded in Pascal-80 were as follows:

Sorting method	Time in seconds for 960 elements
Insertion	988.9
Selection	799.1
Shell	72.0

The times for the sorts are about 7 times faster than interpreted BASIC, but 5 to 14 times slower than compiled BASIC. The advantages of Pascal-80 seem to be limited to the improved program structure which Pascal provides compared to BASIC. There seem to be no advantages in execution speed compared to compiled BASIC.

10. Fortran

Fortran (an acronym for Formula Translating System) is the oldest high-level computer language still in general use. Its ancestry dates back to 1954, and its age certainly shows, even though several updated versions have been produced since then. The latest version, known as Fortran-77, contains several extensions which improve the previous version, known as Fortran-IV.

Microsoft has written a Fortran compiler, sold by Radio Shack for the TRS-80 at \$99.95. Three of the sorting algorithms have been coded for an old version of this compiler, and this coding process caused a few problems.

The Microsoft Fortran has been extended with PEEK and POKE functions which allow it to reference the screen area directly. However, if the byte being PEEKed has the most significant bit set it will be treated as a negative number. This causes all TRS-80 graphic characters to be treated as negative, and thus sorted before the printable ASCII characters.

It took a long time and several gray hairs to get the Shellsort to work. The compiler contained a bug in the comparison of two one-byte values, causing the sort routine to give unexpected results. Thus the statement

```
IF (PEEK(I) .LT. PEEK(I + 1)) GOTO 620
```

will give incorrect results depending on the two one-byte values being PEEKed. The statement can be changed to the following

```
J = PEEK(I)
IF (J .LT. PEEK(I + 1)) GOTO 620
```

which will function correctly. The two sets of state-

ments should be equivalent, but did not give the same results. Since this was an old version of Fortran the bug may not be present in current versions.

The Microsoft Fortran is a true compiler, generating machine language in the compilation process. The generated code should therefore be fast and comparable in speed to the ACCEL3 and ZBASIC compilers. The times were as follows:

Sorting method	Time in seconds for 960 elements
Insertion	83.3
Bubble	175.5
Shell	5.7

The times are comparable with ACCEL and ZBASIC, and much faster than semi-compiled languages such as Pascal-80. The source program is much longer than the BASIC program, since Fortran only allows a single statement on each line. Also there are restrictions on the subscripts allowed for array references, on parameters for DO loops (the equivalent of Basic FOR loops), and on IF statements which only allow a single statement and no ELSE clause.

For those who have been brought up on BASIC, it would probably be something of a disappointment to start programming in Fortran. Fortran also shares a disadvantage with most other compiled languages, that the correction process is long and tedious. First an editor is used to make the corrections, a compiler is then called to perform the compilation, a linker is used to link the program with the required modules from the Fortran relocatable library, and the load module can then finally be called to execute the program.

11. Assembly Language

Theoretically, assembly language should provide the fastest execution speed, but in practice optimizing compilers can often produce better code than programmers who only occasionally write assembly code. The Z80 has a complicated instruction set, and it can be difficult to remember all the instructions and the relative execution speed of each.

Another problem with assembly language is that to provide legible code, the code may have to be more comprehensive or slower than code which can be produced by a compiler. For example I would prefer not to write code which is self modifying, or which, as the interpreter for TRS-80 BASIC, contains jumps into the middle of instructions. For example, a compiler could conceivably generate the following code:

```
      XOR    A      ;Routine entry 1
      DEFB   01H    ;Opcode for LD BC,data16
ENTR2 LD     A,01H  ;Routine entry 2
      DEFB   01H
ENTR3 LD     A,80H  ;Routine entry 3
      PUSH   AF
```

whereas most programmers would probably prefer the following version which uses one byte more for each entry.

```
      XOR    A      ;Routine entry 1
      JR     CONTIN ;Continue
ENTR2 LD     A,01H  ;Routine entry 2
```

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	JR	CONTIN	
ENTR3	LD	A,80H	;Routine entry 3
CONTIN	PUSH	AF	

The second version is much easier to read and understand, and should also be easier to modify if the need arises.

It is possible, without any attempt at optimization of code, to write assembly language programs which are considerably faster in execution than programs compiled with ZBASIC, as the following figures for four different sorting routines show.

Sorting method	Time in seconds for 960 elements
Insertion	11.3
Selection	15.7
Bubble	33.5
Sifting	11.3

The times are about 300 to 600 times faster than interpreted BASIC, and about 4 to 6 times faster than compiled ZBASIC code. The code could be improved, and made even faster. The bubble sort seems to be slower than necessary, and could probably be optimized to be almost as fast as the selection sort.

For execution speed alone it seems that assembly language should be the primary choice, but for speed of coding any of the high level compiled languages could be preferable. Perhaps the ZBASIC compiler is a suitable compromise since machine language code can be embedded directly in BASIC statements where speed is essential, but for most integer arithmetic applications the speed of the ZBASIC compiled code should be adequate.

PROGRAM LISTING

```

10 '
20 'SORT demonstration program
30 'Programmed by Arne Rohde, Pilevej 31, 7600 Struer
40 'Denmark, August 1981
50 DEFINT A-S,U-Z:DEFSTR T:B=15360:DIM S1(12),S2(12),R(959)
60 CLS:PRINT@512,"Generating random array":FOR I=0 TO 959:
R(I)=RND(160)+31:NEXT I
70 CLS
80 PRINT "      S O R T I N G   D E M O N S T R A T I O N"
90 PRINT:PRINT "Choose sorting method to demonstrate."
100 PRINT "1 for insertion sort"
110 PRINT "2 for selection sort"
120 PRINT "3 for bubble sort"
130 PRINT "4 for sifting sort"
140 PRINT "5 for shuttle sort"
150 PRINT "6 for Shell sort"
160 PRINT "7 for quicksort"
170 PRINT "8 for new data array"
180 PRINT "9 to exit"
190 TK=INKEY$:IF TK<"1" OR TK>"9" THEN 190
200 IF TK="9" THEN 1400 ELSE IF TK="8" THEN 60
210 VT=VAL (TK)
220 LINE INPUT "Array size (1 - 960)? ";TK
230 AM=VAL(TK):IF AM<1 OR AM>960 THEN 70 ELSE AM=AM+8-1
240 CLS
250 ON VT GOTO 300, 400, 500, 600, 700, 900, 1100
260 GOTO 70
300 AE=B:PRINT @960,"Insertion sort";
310 AN=R(AE-B):POKE16383,AN:AN=PEEK(16383)
320 I = AE - 1

```

```

330 IF I>=B THEN IF AN < PEEK(I) THEN POKE I+1,PEEK(I): I = I
- 1: GOTO 330
340 POKE I+1,AN: AE=AE+1:IF AE<=AM THEN 310
350 GOTO 1500
400 FOR I=B TO AM:POKE I, R(I-B):NEXT:PRINT @960,"Selection
sort";
420 FOR J=B TO AM-1:NKV = PEEK(J)
430 FOR I=J+1 TO AM
440 IF PEEK(I) < NKV THEN NKV = PEEK(I): NIP = I
450 NEXT
460 IF NKV<PEEK(J) THEN AW=PEEK(J):POKE J,PEEK(NIP):POKE
NIP,AW
470 NEXT
480 GOTO 1500:REM Extraction completed
500 FOR I=B TO AM:POKE I, R(I-B): NEXT: PRINT @960, "Bubble
sort";
510 AE=AM+1
520 PLE = AE - 2
530 IF PLE < B THEN 580: REM sort complete
540 PE = PLE: PLE = -1: FOR I = B TO PE
550 IF PEEK(I) > PEEK(I + 1) THEN AW = PEEK(I): POKE I,PEEK(I
+ 1): POKE I + 1, AW: PLE = I - 1
560 NEXT I
570 GOTO 530: REM repeat until no exchange
580 GOTO 1500:REM Sort terminated
600 FOR I=B TO AM:POKE I, R(I-B): NEXT: PRINT @960, "Sifting
sort";
610 AE=AM+1
620 FI = B
630 FI = FI + 1: IF FI >= AE THEN 690: REM Forw pass end
640 IF PEEK(FI) >= PEEK(FI - 1) THEN 630
650 AW = PEEK(FI): POKE FI, PEEK(FI - 1): BI = FI
660 BI = BI - 1
670 IF BI > B THEN IF PEEK(BI - 1) > AW THEN POKE BI, PEEK(BI
- 1): GOTO 660
680 POKE BI, AW: GOTO 630
690 GOTO 1500: REM Sort end
700 FOR I=B TO AM:POKE I, R(I-B): NEXT: PRINT @960, "Shuttle
sort";
710 AE=AM+1
720 PLE = AE - 2: PFE = B
730 IF PLE < PFE THEN 820: REM sort complete
740 PE = PLE: PLE = -1: FOR I = PFE TO PE
750 IF PEEK(I) > PEEK(I + 1) THEN AW = PEEK(I): POKE I,PEEK(I
+ 1): POKE I + 1, AW: PLE = I - 1
760 NEXT I
770 IF PLE < PFE THEN 820
780 PE=PFE+1: PFE = PLE: FOR I=PLE + 1 TO PE STEP -1
790 IF PEEK(I) < PEEK(I-1) THEN AW=PEEK(I):POKE I,PEEK(I-1):
POKE I-1,AW: PFE = I-1
800 NEXT
810 GOTO 730: REM repeat until no exchange
820 GOTO 1500:REM Sort terminated
900 FOR I=B TO AM:POKE I, R(I-B): NEXT: PRINT @960,"Shell
sort";
910 AE=AM+1
920 DST = 1: IF AE - B < 2 THEN 1040:REM Already in sequence
930 IF 4 * DST + 3 < AE - B THEN DST = DST * 2 + 1: GOTO 930
940 FOR I = B TO B + DST - 1
950 FOR FI = I TO AE - DST - 1 STEP DST
960 IF PEEK(FI) <= PEEK(FI + DST) THEN 1010: REM Sequence OK
970 AW = PEEK(FI + DST): POKE FI + DST, PEEK(FI)
980 BI = FI
990 IF BI - DST >= B THEN IF PEEK(BI - DST) > AW THEN POKE BI,
PEEK(BI - DST): BI = BI - DST: GOTO 990
1000 POKE BI, AW
1010 NEXT FI
1020 NEXT I
1030 DST = INT(DST / 2): IF DST > 0 THEN 940

```

```

1040 GOTO 1500:REM Sort completed
1100 FOR I=B TO AM:POKE I, R(I-B):NEXT: PRINT@960, "Quicksort";
1110 AE=AM+1
1120 S1(0) = B: S2(0) = AE - 1: REM set array limit
1130 SP = 1: REM One portion remaining
1140 IF SP < 1 THEN 1270: REM No more portions - end
1150 SP = SP - 1: IL = S1(SP): IH = S2(SP)
1160 IF IH-IL < 11 THEN 1280
1170 I = (IH + IL) / 2: REM Middle item index
1180 AP = PEEK(I): REM Make pivot = A(middle)
1190 JL = IL: JH = IH: REM indexes for search
1200 IF PEEK(JL) < AP THEN JL = JL + 1: GOTO 1200
1210 IF PEEK(JH) > AP THEN JH = JH - 1: GOTO 1210
1220 IF JH<JL THEN 1250
1230 AW = PEEK(JL): POKE JL, PEEK(JH): POKE JH, AW
1240 JL = JL + 1: JH = JH - 1: IF JL<=JH THEN 1200
1250 IF (JL - 1 - IL) < (IH - JL) THEN S1(SP) = JL: S2(SP) =
IH: IH = JL-1 ELSE S1(SP) = IL: S2(SP) = JL - 1: IL = JL
1260 SP = SP + 1: GOTO 1160: REM Use smallest portion
1270 GOTO 1500: REM Sort completed
1280 JH=IL+1
1290 IF JH>IH THEN 1140
1300 JL=JH-1:AW = PEEK(JH)
1310 IF JL >= IL THEN IF AW < PEEK(JL) THEN POKE JL+1,
PEEK(JL): JL = JL - 1: GOTO 1310
1320 POKE JL+1,AW: JH=JH+1: GOTO 1290
1400 END
1500 PRINT @1000,"Hit any key to continue";
1510 TK=INKEY$:IF TK="" THEN 1510 ELSE 70File PG5604: Sorting it
out

```

12. Summary

The following table presents a summary of all the

timings measured for the various sorting algorithms and the various languages.

	Insert	Select	Bubble	Sift	Shuttle	Shell	Quick
BASIC	7009		10260		8755	438	391
Compressed						344	268
ACCEL2	77.8	157.1	196.8	85.4	146.9	6.0	5.6
ACCEL3	74.4	163.7	231.1	80.1	165.7	6.9	4.8
ZBASIC	68.2	90.7	127.8	65.8	97.5	5.3	2.9
Forth	379.7	262.8				29.5	10.4
Pascal80	988.9	799.1				72.0	
Fortran	83.3		175.5			5.7	
Assembler	11.3	15.7	33.5	11.3			

13. Further Measurements

Several other languages and compilers are available for the TRS-80, but not all of them allow for direct reference to the screen area. I have the TRS-80 Cobol compiler, but it does not contain any instructions which allow for direct reference to memory. The sorting routines could be coded to sort an array and then write the result to the screen, but this would make the program completely different from the others.

Readers are welcome to try the BASIC program on any other BASIC compilers, or to recode the program in any other language which allows for direct memory references. It would be interesting to see the execution speeds for these programs.

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PRACTICAL BUSINESS PROGRAMS

S. M. Zimmerman and L. M. Conrad

Month #4: CPA Program to Produce Balance Sheet and Profit and Loss Statement

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This month continues the review of the second group of programs in our general ledger set. The first program in this group, TRANS, was reviewed last month. TRANS is used to input the initial values of a data set. This month's program is CPA, the program which produces the balance sheet and profit and loss statement. The last program in this group is TRIAL. The principal function of the TRIAL is to produce a trial balance to be used in the task of tracing down errors. We have found the trial balance program is seldom used, however when an error occurs it is needed.

With the addition of the CPA program you may now set up your chart of accounts, input your transactions, and produce a periodic set of accounting reports.

The publication schedule for the general ledger system is as follows:

No	Month	Program
1.	GLMENU (Controls use of routines).
2.	NAME & START (Initializes chart of accounts and firms name).
3.	TRANSACTION (Inputs monthly transactions).
4.	CPA (Produces Balance sheet & Income and Expense statements, Profit & Loss statement).
5.	UPDATE & YEAR (Changes chart of accounts and performs year end closing tasks).
6.	TRIAL (Produces trial balance).
7.	BALANCE (Balances check book).
8.	MILES & MOVE (Calculates gas mileage and moves files between disks).

The operational procedures of for CPA will be reviewed.

RUNNING THE PROGRAM

CPA is designed to work on a printer only. The intent is to produce an account report set for review by management. If you wish a set to work on the printer only we recommend you make two copies of CPA. Name one CPA and the other CRT. In the case of the CRT version change all the LPRINTs to PRINTs. You will also have to add a counter to stop the material on the screen so it may be read. We wrote such a version and found we never used it, so we dropped it from our accounting set.

The objective of CPA is to produce a profit and loss statement and a balance sheet. The title information will be printed out first:

THIS IS CPA PRINTER OUTPUT FOR P&L/BALANCE SHEET

The first question is necessary if you are using an operating system with its own line counter.

The next question is relative to the name of the current transaction file. This is the file you created when you ran the transaction program TRANS.

CURRENT TRANS?

The name we gave to this file in our example was MAY. The next question is relative to a line counter:

LINE COUNTER (Y/N)?

If your system does not have a built in line counter this question can be eliminated by leaving out line 40 when you copy the program.

OLD BAL?

The OLD BAL or old balance sheet information is the information you have to carry forward from the previous month. We named the old balance file APRIL2 last month and in the next question will name the new OLD BAL MAY2.

NEW OLD BAL?

The next question is relative to the disk used.

DISK?

You will next be asked for the date to be placed on the run.

DATE?

The profit and loss statement will be printed on your printer. When it is complete the balance sheet will be printed on the printer. You will be given the opportunity to line up your paper to print the balance sheet after the profit loss statement is complete.

SETUP FOR BALANCE SHEET AND ENTER?

When the program is complete you will automatically return to GLMENU.

EXAMINING THE PROGRAM

The program starts out with a CLEAR 290 to make room for the string variables to be used. If your chart of accounts is greater than 70, there is some possibility you will get an OUT OF STRING SPACE error. If you do, all that is necessary is to increase the 290 until the error disappears. If you increase 290 to far with only 32k in your system you could run out of memory. This is the reason we have kept this number low.

Line 20 defines the format to be used to print the information on your printer. If your business requires bigger numbers than the formats given, all you need to do is to increase the size and line up the headings. The size of the format used was selected so as to fit on an 80 column printer and perform the task for our business. To increase the format you add ## signs where wanted. In E\$ the first set of pound signs is for the account number, the second set is for the debits and the third set is

for the credits.

Line 360 and 560 also contain formats which may have to be adjusted for businesses with bigger numbers. Line 360 is for the profit and loss statement, line 560 prints the totals.

As noted in the section on using the program, line 40 is included to allow the program to be used with operating systems such as DOSPLUS which have built in line counters.

Line 50 and 60 input the name of the files to be used and the disk upon which you want to write the files. Line 70 inputs the information from a file called NO. In this file is stored the number of current assets, fixed assets, etc.

Line 80 inputs the date and prints it on the printer. Line 90 inputs the values of the debit and credits associated with each of the accounts in the chart of accounts. Lines 100 and 110 input the values of the transactions. In line 100 we placed an upper limit of 999 transactions per period on our system by the TO 999 in the middle of the line. If you need to increase this number you may do so.

In line 120 we close the file we have just read in. At no time in our system are more than three files open at any one time. When you start your system you do not need a special file specification.

Lines 130-150 input and print the name to be placed on top of the accounting reports.

From this point the program jumps to line 270 for the purpose of closing the books. This task is complete by line 330 and the job of printing the profit and loss statement begins. We used the old term profit and loss in line 340 to title our statement. You need only change profit and loss to income and expense if you feel like it.

From this point on to line 630 the task of printing the profit and loss statement is performed. When this job is complete the program is directed to go to line 170 to print the balance sheet. The task of printing the balance sheet is completed in line 260. At this point the program automatically returns to GLMENU.

PROGRAM LISTING

```
10 CLEAR 290:REM "CPA"
20 E$="### % % #.###.###.###"
   ##.###.###.###"
30 CLS: PRINT "THIS IS CPA PRINTER ONLY OUTPUT FOR P&L/BALANCE
SHEET": INPUT "CURRENT TRANS";BZ$:N0$="NO":FF$="FILE"
40 INPUT "LINE COUNTER (Y/N)";LC$: IF LC$="Y" THEN
CMD"FORMS(T)"
50 INPUT "OLD BAL";NX$: INPUT "NEW OLD BAL ";NQ$: INPUT "DISK
";DZ$:FQ$=FF$+"N"
60 NP$=NX$+"P":NZ$=NQ$+"P"+": "+DZ$:NQ$=NQ$+": "+DZ$:SU=0
70 OPEN"I",1,N0$: FOR I=1 TO 6: INPUT #1,P:N(I)=P:SU=SU+P:
NEXT I: CLOSE 1:Z=SU: DIM X$(Z,2),S$(Z,2),QP(Z),QQ(Z)
80 INPUT "DATE";DA$: LPRINT DA$
90 OPEN"I",1,NX$: FOR I=1 TO SU: INPUT#1,X$(I,1),X$(I,2):
NEXT I
100 CLOSE 1: OPEN"I",1,BZ$: FOR I=1 TO 999: INPUT #1,P1%,P2%,
P3%,P4%,A1#,A2#:K=P3%:KK=P4%: IF P1%=0 THEN 120
110 X$(K,1)=X$(K,1)+A1#:X$(KK,2)=X$(KK,2)+A2#: NEXT I
120 CLOSE 1
130 OPEN"I",1,FQ$: FOR I=1 TO 5: INPUT #1,PP$: LPRINT PP$
140 NEXT I
150 CLOSE 1
```

continued on page 43

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ASK RICHARD

Richard Kaplan

Last month you advised against using aluminum foil for mailing diskettes, stating that this can cause serious harm but achieves nothing positive. This seems to be quite a common practice. Are you sure that information was correct?

That point does deserve an explanation. Aluminum foil *will*, indeed, protect a diskette against magnetic fields.

Then why did you advise against using aluminum foil to mail diskettes?

The dangers of static electricity are magnified if the aluminum foil touches the surface of the diskette (inside the jacket). This is why I cautioned not to use aluminum foil. However, if you place the diskette in its paper jacket, the actual diskette surface will not be exposed. Thus, as long as a diskette is in its protective paper jacket, aluminum foil can, indeed, offer protection against damage.

You mentioned that aluminum foil provides protection against "magnetic fields." Aren't X-rays also a source of danger, as in the classic rubber stamp, "Magnetic Media—Do Not X-ray"?

There is little evidence to demonstrate that X-rays, such as those used in an airport or post office to inspect packages, cause measurable damage to a diskette. X-rays do not affect magnetic media, such as diskettes. Damage to floppy diskettes (erasure of information) is often caused by a source such as a magnet or a paper clip which has become magnetized.

Does the diskette with the disk operating system on it have to always remain in the drive, or is it used only when the computer is first turned on?—Stan Smith; Clearwater, Florida

If you load BASIC from a diskette ("Disk BASIC"), the operating system (TRSDOS) usually must remain in the first drive (drive 0, often called the "system drive"). This is necessary because not all of BASIC is loaded into the computer at one time. Some commands in a program require the computer to load instructions from the diskette in order to find out what the command means. Thus, as a general rule, a diskette containing the disk operating system must always remain in the system drive. But there are some exceptions to this rule: for example, during the operation of a utility such as BACKUP, you may temporarily have a non-system diskette in the system drive, as when copying a non-system diskette onto a blank diskette.

What did you mean when you said, "if" you load BASIC from disk?

Both the Model I and Model III already have a version of BASIC installed in the machine itself in the form of ROM (read-only memory, or "permanent" memory). This version of BASIC is commonly referred to as "Level II BASIC," or "Cassette BASIC," since it is the version which is used on a TRS-80 equipped only with a cassette recorder.

How is Cassette BASIC different from Disk BASIC?

Disk BASIC contains more features than Cassette BASIC does, such as built-in sorting (alphabetizing)

command on the MODEL III.

How can I get to Cassette BASIC on my disk-based computer?

On the Model I or Model III (the Model II does not have Cassette BASIC) you can choose to use Cassette BASIC by pressing BREAK and simultaneously depressing the RESET key.

Why would I want to use Cassette BASIC on my diskette system?

Since Cassette BASIC is in "permanent" memory (ROM), it does not occupy any "temporary" memory (RAM). Therefore, more room is available for your programs and data.

I have heard computers referred to as "8-bit" or "16-bit." What does this mean, and is it significant in choosing a computer?

A bit is the smallest unit of information stored in a computer. (8 bits make up a byte, which is generally equal to one character in computer memory.) An 8-bit computer can only work with 8 bits of information in its primary "arithmetic center" at one time. When a computer can deal with more bits at one time, it is capable of more complex operations. A 16-bit computer, dealing with 16 bits at once, can perform more complex calculations with more information at one time, and 16-bit computers often seem to operate far faster than 8-bit computers. Another very important advantage of 16-bit computers is their ability to take advantage of far more memory space. An 8-bit computer can only directly "address" (use) a maximum of 64K of memory. A 16-bit computer is capable of addressing 512K of memory at once. A computer that has more memory space can perform much of its work on data that is present in memory, without having to repeatedly load and save data on a disk. For instance, if you have to search through a data file on a diskette for information, it will take much longer than if you are able to load the entire file into memory at once, and then just search through memory instead.

Are there computers which use more than 16-bits?

Yes. Generally, the number of bits a computer can deal with at once defines the "size category" into which a computer falls. Microcomputers generally use 8 or 16 bits. Minicomputers can handle 16 or sometimes 32 bits. Mainframe computers (which sometimes fill a whole room) generally use 32 bits and can often work with as much as 64 bits of information at one time when performing certain complex operations.

I know that a big selling point of the TRS-80 Model 16 is its 16-bit capability. Should I buy this computer because of this?

If you are thinking in terms of the future, *maybe*. In terms of the present, no.

Why should I not buy the Model 16 now because of its 16-bit capability?

Before any computer becomes useful, software must be available. Unfortunately, very little 16-bit software is currently available for the Model 16. Most software

operates by simulating a Model II on a Model 16. In particular, a 16-bit version of BASIC, which would take advantage of the 16-bit processor's greater capabilities, is not yet available for the Model 16. As a result, programs written in BASIC will have little noticeable speed improvement (except possibly for faster diskette-access time.)

But if I am thinking about the future, wouldn't it be wise to purchase a Model 16 now, since it will eventually have 16-bit software available?

Probably not. Radio Shack recently introduced the Model 12, which is apparently a replacement for the Model II. Some people feel that, when upgraded to Model 16 capability, the Model 12 may be a more advanced computer than the regular Model 16 is! In fact, rumors are circulating that the Model 16 may itself be discontinued. (See this month's "Crystal Ball" for more on the Model II/12/16 story.)

You said earlier that 8-bit computers can use 64K of memory, and I know that the Model II has 64K. But if the Models I and III are also 8-bit computers, why can they only get a maximum of 48K?

The Model I and Model III both do have 64K of memory, but 16K is in the form of ROM which holds information that the computer needs to have access to, such as Cassette BASIC (discussed earlier) and instructions needed to generate characters and place them onto the video screen. Since the computer can only address 64K, and 16K is used for the ROM, only 48K of "addressing space" is left over for RAM.

Speaking of "memory for the video screen," I've often heard it said that my TRS-80 has a memory mapped video display. What does this mean?

A memory mapped video display is a feature of computers that have an area of memory set aside which reflects exactly what is appearing on the video screen at all times. In order to print a character on the screen, the character is simply placed somewhere in the video memory (the "map" of the screen), and that character instantly appears in a corresponding position on the screen. Any character on the screen can be instantly changed simply by changing one character in the video memory. This feature makes it very easy to create complex and attractive screen displays, as when using features like BASIC's PRINT @ statement. Computers that have the ability to print the contents of the video display on a line printer don't actually read the screen itself—they just read the video map in memory.

What is the alternative to memory-mapping?

A computer without a memory-mapped video display would save some memory, but it would have to use some other method (generally through software) of addressing a specific point on the screen in order to create a "formatted" display. Computers without the ability to address a specific point on the screen (such as video displays for most computers that use "dumb" video terminals) can only add characters to the screen at the current position of the cursor. Video output is then merely a continuous stream of characters sent to

continued on page 38

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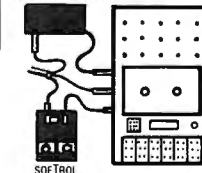
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Gordon Speer

BALL BEARINGS

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```
100 CLS :CLEAR 100
110 PRINT,"B A L L   B E A R I N G S"
120 PRINT"----INCHES----      CM      CC      GRAMS
      N/KG
130 DATA 1/8,5/32,3/16,7/32,1/4,9/32,5/16,3/8,7/16,1/2,5/8,3/4,7/8
140 FOR L=1 TO 13
150 READ S$
160 LET D=VAL(LEFT$(S$,1))/VAL(RIGHT$(S$,LEN(S$)-2))
'DIAMETER
170 LET CM=D*2.54
'DIAMETER IN CENTIMETERS
180 LET V=4/3*3.14*(CM/2)^3
'VOLUME IN CC
190 LET M=V*7.85
'GRAMS EACH
200 LET N=1000/M
'NUMBER PER KILOGRAM
210 PRINT S$;TAB(7)D;TAB(17-SGN(INT(CM)))CM;
220 PRINT TAB(27)V;TAB(39)M;
225 PRINT TAB(50) USING"#####";N
230 NEXT
240 GOTO 240
```

FOOTBALL

Now that the on-again off-again football season is finally over here is a football game you can play on your Level-II computer and video display. If you are curious about the length of it (or any other program) you might like to know that the available memory (?MEM) after loading the program is 5716 bytes less than the available memory before loading it. Therefore your 16K computer will hold programs more than twice this size!

John Kemeny mentions Dartmouth Football in his 1972 book *Man and the Computer*, and I have an idea this version is descended from the Dartmouth-Yale game through many revisions. You should remember Dr. Kemeny, a Hungarian immigrant in 1940, who graduated first in his New York City High School class, graduated summa cum laude from Princeton, worked for Albert Einstein, and served as chairman of the Mathematics Department at Dartmouth before becoming President of Dartmouth College. If you see a car bearing New Hampshire license plates BASIC, that's him. He's co-inventor of the BASIC computer language.

The program plays a pretty good game of football, complete with field goal, safety, and two minute warning, but typical of the older basic programs does not use graphics, because of the limitations of the old teletype terminals originally used with BASIC.

```
100 DIM S(2)
110 CLEAR 100
120 CLS
130 PRINT CHR$(23)
140 PRINT@462,"F O O T B A L L"
150 FOR N=1 TO 3000:NEXT
160 GOSUB 3030
170 PRINT
180 PRINT "THIS IS BIG 8 FOOTBALL
190 PRINT "I WILL QUARTERBACK OKLAHOMA
200 PRINT "YOU WILL QUARTERBACK NEBRASKA
210 PRINT:PRINT "CALL PLAYS BY NUMBER:"
220 GOSUB 240
230 GOTO 260
240 PRINT"1=RUN","2=TRICKY RUN","3=SHORT PASS","4=LONG
PASS","5=PUNT","6=QUICK KICK","7=PLACE KICK (FIELD GOAL)"
250 RETURN
260 PRINT
270 Z=0
280 T=0
290 S(0)=0
300 S(2)=0
310 PRINT "TOSS OF COIN: H OR T?"
320 Z$=INKEY$
330 IF Z$="H" THEN 360
340 IF Z$="T" THEN 360
350 GOTO 320
360 ON RND(2) GOTO 370 ,420
370 PRINT "OKLAHOMA WON THE TOSS"
380 GOSUB 3010
390 P=1
400 X=40
410 GOTO 460
420 PRINT "NEBRASKA WON THE TOSS"
430 GOSUB 3010
440 P=-1
450 X=60
460 Y=55+FIX((.5-RND(0))*10)
470 GOSUB 3010
480 PRINT"KICKOFF IS GOOD FOR"Y"YARDS"
490 GOSUB 3010
500 Y1=20+FIX((RND(0)-.5)*10)
510 IF RND(0)<.8 THEN 530
520 Y1=Y1+FIX(RND(0)*80)
530 Y=Y-Y1
540 PRINT "RETURN IS GOOD FOR"Y1"YARDS"
550 GOSUB 3010
560 GOTO 1000
570 P=1
580 X=20
590 X1=20
600 D=1
610 PRINT "NEBRASKA'S BALL ON THEIR OWN 20 YARD LINE"
620 GOSUB 3010
630 GOTO 190
640 GOSUB 240
650 PRINT"NEXT PLAY-";
660 A$=INKEY$
670 Z=VAL(A$)
680 IF ABS(Z-4)<4 THEN 700
690 GOTO 660
700 R=RND(0)
710 R1=RND(0)
720 F=0
730 IF Z>4 THEN 830
```



```

740 IF Z<3 THEN 1020
750 PRINT "IT'S A PASS-";
760 GOSUB 3010
770 IF Z=3 THEN 1160
780 Y=FIX(160*(R1-.5)/3+30)
790 IF R<.1 THEN 1240
800 IF R<.25 THEN 1310
810 IF R<.7 THEN 1270
820 GOTO 1210
830 Y=FIX(100*(R-.5)/3+40)
840 IF Z=7 THEN 2770
850 IF D=4 THEN 870
860 Y=FIX(Y*1.3)
870 PRINT "PUNT IS GOOD FOR"Y"YARDS"
880 GOSUB 3010
890 IF X+P*Y<0 THEN 2350
900 IF X+P*Y>100 THEN 1650
910 IF F=-1 THEN 930
920 IF D<4 THEN 1000
930 Y1=5+FIX((.5-RND(0))*14)-F*FIX(Y*RND(0)/3)
940 IF RND(0)<.9 THEN 960
950 Y1=Y1+FIX(RND(0)*80)
960 Y=Y1
970 F=-1
980 GOSUB 2970
990 PRINT "RUN BACK IS GOOD FOR"Y1"YARDS"
1000 F=-1
1010 GOTO 1510
1020 PRINT "RUN - RUN - RUN"
1030 GOSUB 3010
1040 IF Z=2 THEN 1100
1050 Y=FIX(32*(R-.5)/3+3)
1060 IF R1<.05 THEN 1130
1070 IF R1<.95 THEN 1330
1080 Y=FIX(RND(X)*60)+Y
1090 GOTO 1120
1100 Y=FIX(20*R-5)
1110 IF R1>.85 THEN 1080
1120 IF RND(0)>.13 THEN 1330
1130 F=-1
1140 PRINT "FUMBLE *** FUMBLE"
1150 GOTO 1330
1160 Y=FIX(60*(R1-.5)/3+8)
1170 R=RND(0)
1180 IF R<.05 THEN 1240
1190 IF R<.15 THEN 1310
1200 IF R<.55 THEN 1270
1210 PRINT "COMPLETE"
1220 IF RND(0)>.85 THEN 1080
1230 GOTO 1330
1240 PRINT "INTERCEPTED AFTER"Y"YARDS"
1250 F=-1
1260 GOTO 890
1270 PRINT "INCOMPLETE"
1280 GOSUB 3010
1290 Y=0
1300 GOTO 1330
1310 PRINT "QUARTERBACK SACKED ";
1320 Y=-FIX(10*R1)
1330 GOSUB 2970
1340 IF F=0 THEN 1360
1350 PRINT "AFTER ";
1360 IF Y<0 THEN 1410
1370 IF Y=0 THEN 1470
1380 PRINT "GAIN OF"Y"YARDS"
1390 FOR Q=1 TO 700:NEXT

```

continued on page 32

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FOOTBALL

continued from page 31

```

1400 GOTO 1420
1410 PRINT "LOSS OF";-Y;"YARDS"
1420 IF F=>0 THEN 1510
1430 IF RND(0)>.5 THEN 1510
1440 PRINT "FUMBLE RECOVERED"
1450 F=0
1460 GOTO 1510
1470 PRINT "NO GAIN"
1480 GOSUB 3010
1490 IF F<0 THEN 1430
1500 GOTO 1770
1510 X=X+P*Y
1520 IF X<=0 THEN 2240
1530 IF X>50 THEN 1570
1540 PRINT "BALL ON NEBRASKA'S"X"YARD LINE"
1550 GOSUB 3010
1560 GOTO 1770
1570 IF X>=100 THEN 1610
1580 PRINT "BALL ON OKLAHOMA'S"100-X"YARD LINE"
1590 GOSUB 3010
1600 GOTO 1770
1610 IF P<0 THEN 1670
1620 IF F<0 THEN 1650
1630 P=-1
1640 GOTO 1740
1650 PRINT "TOUCHBACK - OKLAHOMA"
1660 GOTO 1900
1670 IF F<0 THEN 1740
1680 PRINT ">>>>> SAFETY <<<<<"
1690 GOSUB 2630
1700 PRINT "OKLAHOMA MAKES A FREE KICK FROM THEIR 20"
1710 X=80
1720 P=-1
1730 GOTO 460
1740 PRINT ">>>TOUCHDOWN<<< BIG RED!!!"
1750 GOSUB 2670
1760 GOTO 390
1770 D=D+1
1780 IF F>=0 THEN 1860
1790 IF P>0 THEN 1830
1800 PRINT "NEBRASKA'S BALL"
1810 P=1
1820 GOTO 1930
1830 PRINT "OKLAHOMA'S BALL"
1840 GOSUB 3010
1850 GOTO 1920
1860 IF P*(X-X1)>=10 THEN 1930
1870 IF D<5 THEN 2010
1880 IF P<0 THEN 1800
1890 GOTO 1830
1900 X=80
1910 PRINT "SOONERS' BALL ON THEIR 20"
1920 P=-1
1930 D=1
1940 PRINT "FIRST DOWN"
1950 GOSUB 3010
1960 IF P*X<P*(50+P*40) THEN 1990
1970 X1=50+P*40
1980 GOTO 2080
1990 X1=X
2000 GOTO 2080
2010 ON D GOTO 2020,2030,2040,2050
2020 PRINT"FIRST";:GOTO 2060
2030 PRINT"SECOND";:GOTO 2060
2040 PRINT"THIRD";:GOTO 2060

```

```

2050 PRINT"FOURTH";
2060 PRINT" DOWN AND"10+P*(X1-X)"YARDS TO GO"
2070 GOSUB 3010
2080 PRINT
2090 T=T+1
2100 IF T<45 THEN 2140
2110 PRINT
2120 PRINT">>>>> TWO MINUTE WARNING <<<<<"
2130 PRINT
2140 IF T<50 THEN 2220
2150 IF RND(0)>.2 THEN 2220
2160 PRINT
2170 PRINT "END OF THE GAME"
2180 GOSUB 3010
2190 GOSUB 3030
2200 RUN
2210 RUN
2220 IF P>0 THEN 640
2230 GOTO 2400
2240 IF F<0 THEN 2340
2250 IF P>0 THEN 2280
2260 P=1
2270 GOTO 2370
2280 PRINT "SAFETY"
2290 GOSUB 2630
2300 PRINT "NEBRASKA TAKES A FREE KICK FROM THEIR OWN 20 YARD
LINE"
2310 X=20
2320 P=1
2330 GOTO 460
2340 IF P>0 THEN 2370
2350 PRINT "TOUCHBACK NEBRASKA"
2360 GOTO 570
2370 PRINT "TOUCHDOWN OKLAHOMA"
2380 GOSUB 2670
2390 GOTO 440
2400 P=-1
2410 IF D>1 THEN 2470
2420 IF RND(0)>.5 THEN 2450
2430 Z=3
2440 GOTO 700
2450 Z=1
2460 GOTO 700
2470 IF D<4 THEN 2540
2480 IF X<=30 THEN 2510
2490 Z=5
2500 GOTO 700
2510 IF 10+X-X1<3 THEN 2420
2520 Z=7
2530 GOTO 700
2540 IF 10+X-X1<5 THEN 2420
2550 IF X>X1 THEN 2610
2560 IF RND(0)>.5 THEN 2590
2570 Z=2
2580 GOTO 700
2590 Z=4
2600 GOTO 700
2610 IF RND(0)>.25 THEN 2590
2620 GOTO 2570
2630 S(1-P)=S(1-P)+2
2640 GOSUB 3030
2650 FOR Q=1 TO 2000:NEXT:PRINT
2660 RETURN
2670 FOR Q=1 TO 2000:NEXT:IF RND(0)>.8 THEN 2720
2680 PRINT "KICK IS GOOD!!"
2690 S(1-P)=S(1-P)+7
2700 GOSUB 3010

```

```

2710 GOTO 2640
2720 PRINT "KICK IS BLOCKED"
2730 S(1-P)=S(1-P)+6
2740 GOSUB 3010
2750 GOTO 2640
2760 PRINT
2770 PRINT "PLACE KICK"
2780 F=-1
2790 IF R>.15 THEN 2830
2800 PRINT "KICK IS BLOCKED"
2810 Y=-5
2820 GOTO 1510
2830 IF P*(X+P*Y)>=P*(P*60+50) THEN 2900
2840 IF P*(X+P*Y)<P*50+50 THEN 2880
2850 PRINT "KICK IS WIDE OF THE GOAL"
2860 IF P=1 THEN 1650
2870 GOTO 2350
2880 PRINT "KICK IS SHORT"
2890 GOTO 500
2900 PRINT "FIELD GOAL!!!!"
2910 P=-P
2920 S(1-P)=S(1-P)+3
2930 GOSUB 3010
2940 GOSUB 2640
2950 IF P=1 THEN 440
2960 GOTO 390
2970 X2=X+P*Y
2980 IF X2>=100 THEN 1610
2990 IF X2<=0 THEN 2240
3000 RETURN
3010 FOR Q=1 TO 1000:NEXT

```

```

3020 RETURN
3030 'SUBROUTINE FOR GRAPHICS
3040 CLS:PRINT CHR$(23)
3050 PRINT"          SCORE"
3060 PRINT:PRINT"          NEBRASKA"S(2)
3070 PRINT:PRINT"          OKLAHOMA"S(0)
3080 PRINT@960,"G 10 20 30 40 50 40 30 20 10 G";
3090 PRINT@144,STRING$(14,140);
3100 PRINT@272,STRING$(14,140);
3110 PRINT@400,STRING$(14,140);
3120 PRINT@448,STRING$(30,140);
3130 PRINT@896,STRING$(30,140);
3140 X=32:FOR Y=7 TO 19:SET(X,Y):NEXT
3150 X=88:FOR Y=7 TO 19:SET(X,Y):NEXT
3160 FOR X=0 TO 120 STEP 12
3170 FOR Y=22 TO 43
3180 SET(X,Y)
3190 NEXT
3200 NEXT
3210 FOR N=1 TO 3000:NEXT
3220 CLS:PRINT CHR$(23)
3230 RETURN
3240 '
3250 'ADAPTED FOR LEVEL-II
3260 'BY MR GORDON E. SPEER

```

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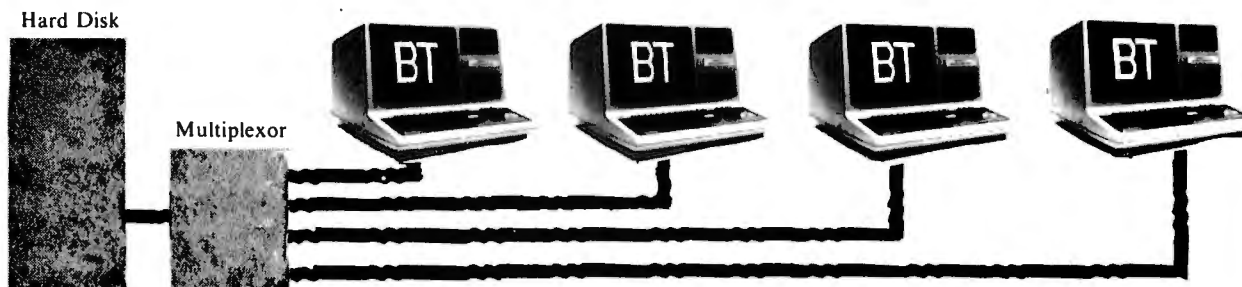
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COLOR COMPUTER CORNER

55 COLOR COMPUTER PROGRAMS

One of the big problems facing all Color Computer users is where to find software and information about their computer. The Color Computer is a powerful and versatile machine, but support from Radio Shack and others has been so slow in coming that many owners feel a constant frustration when searching for software and books. Well, a few companies are finally starting to concentrate on this relatively undeveloped market, and one of them is ARCsoft Publishers, who now have several books devoted exclusively to the TRS-80 Color Computer. We're going to briefly cover one of those books this month.

55 COLOR COMPUTER PROGRAMS FOR THE HOME, SCHOOL, AND OFFICE

This book has a lot of good points to recommend it. The programs are generally quite useful, designed for small businesses, students and teachers, or anyone who wants to get more out of their Color Computer. Each program is clearly described, with a complete explanation of its operation, and the program listings themselves are presented in a large, uncommonly clear typeface (this is a very important point, as anyone who's ever typed in a program out of a book will understand). In addition to providing users with many practical programs, this book will also provide many insights for programming novices. The book is divided into seven sections by type of program. A highlighting of the most interesting programs follows.

Business programs for the Color Computer are a real rarity, so every program in this section is important. Here's some details of some of the best programs:

PROFIT ESTIMATOR helps answer a common question in the business office. Whether your business sells great quantities of wholesale merchandise, smaller quantities over the counter, or single items via mail order, you need to be able to get a fast estimate of your expected cash flow and potential profits. This program provides an "instant advisor," allowing fast comparisons for quick decisions.

Given information about quantities of items, prices, quantity sold, discounts, etc., the program will calculate unit price, unit profit, gross profit, return percentages, sales needed to break even, and more (depending on which part of the program you're using).

INVOICING is a program that is designed to speed up the process of calculating all of the various totals needed to fill in an invoice. After entering information for each item sold, the program will display the total retail price of the items on the invoice, sales tax (if applicable), shipping charges and the total due. This data can then be quickly entered on the invoice, or, if you have a printer attached, you can easily modify the program to print out the results on paper.

WAGES is designed as a quick calculator of gross wages for all your employees. Given hours and pay rate for each employee, the program returns the gross pay for each, including overtime for employees who have worked over 40 hours.

INVENTORY REVIEW this time saving program is designed to produce a useful report of inventory levels and other helpful information. After entering product descriptions, names of suppliers, retail price and quantity presently on hand, the program will sort all of the information and then produce an inventory report, sorted alphabetically by manufacturer, then again sorted by product name. Whether you have results displayed on the video screen, or print them on your printer, the report will include total number of items in inventory, number of different items in various price ranges, and total retail value of the inventory.

Other programs in this section provide instant calculations of price markups, interest, unit price, and sales commissions, and will produce business graphs and charts.

Programs for students consist of a series of tests on state capitals, major U.S. cities, Canadian provinces, the history of invention, moderate and advanced math "flash" quizzes, a hex chart, ASCII codes, and techniques for graphing.

Teachers will find a useful program for evaluating exam scores, an advanced version that alphabetizes scores by student's names, a universal testing program that accepts any type of questions and answers, and a class roll sorter.

Five music programs are provided: a simple piano program which plays notes when you press keys on the keyboard, a musical scale test, a keyboard music player that shows an animated keyboard while you play a tune, and two preprogrammed tunes: a minuet and a ragtime piece.

A wide variety of other programs are also included, from useful tools to games. Electric bill analysis accepts data for a whole year of bills and reports on your energy usage; two photography programs do calculations for flash exposures and closeups; a program that creates a sorted list of names and addresses; a program that synchronizes graphics on your computer with pretaped sounds from your cassette recorder; a savings account interest calculator; and a series of graphics and game programs: **DRAW STRAWS**, **UP IN LIGHTS**, **DICE**, **PASSWORD**, **CIVILIZATION**, **KALIEDOSCOPE**, **SKETCH PAD**, **BLINKING MAN**, **CHINESE WATER TORTURE**, **THE TUNNEL**, **PORTHOLE**, **WAVING WOMAN**, and **YELLOW TIME BOMB**.

The book ends up with a useful appendix that gives a series of charts of Color BASIC and Extended Color BASIC functions and statements, operators, video and graphics control codes, control keys, special characters and error messages.

This book will be a welcome addition to the library of any Color Computer owner, and by using these programs you'll become familiar with many programming techniques that you can put to use immediately in your own programs.

55 Color Computer Programs for the Home, School, and Office by Ron Clark, published by Arcsoft Publishers, Woodboro MD 21798, 126 pages (paper), \$9.95. Available from H & E Computronics, (800) 431-2818. ■

POCKET COMPUTER CORNER

Steven M. Zimmerman, Leo M. Conrad, and Stanley M. Zimmerman

This Month Inspection Experiment/Game

Copyright© 1983 Zimmerman, Conrad, and Zimmerman

This pocket computer experiment/game is designed to aid in the understanding of the limitations of 100% inspection and in number recognition for a young person. Because the program is written on the pocket computer it may be played anytime by a child, or may be used in a professional meeting if enough pocket computers are available.

The game consists of identifying how many three or less digit numbers of the numbers printed on the computer's display, are between a lower specification limit and an upper specification limit inclusive. For a child, use it is suggest you make the game simpler by defining the lower limit as zero and asking the child to count the number of numbers less than 100, or the number of two digit numbers rather than three etc. The use of this program, like many other, is limited only by your imagination.

The computer is started with a seed number and then proceeds to produce a series of random numbers. As they are produced, the computer counts the number beyond the defined limits and prints the random number of the display with a PAUSE statement for a small amount of time. To play the game the player counts the number of numbers in the define range as the numbers are flashed on the display. When the game is over the players results may be compared to the computer's count.

PLAYING THE GAME

Make sure the computer is in the RUN or DEFInable modes before you try to run it. Typing R. ENTER starts the program in either mode. The first thing you will see is INSPECTION EXPERIMENT on the computer's display. The next thing you see is the question:

(N)EW (R)UN?

This menu allows you to start a new cycle with a new random number, or to run a new cycle using the random number currently in the computer. It is suggested you continue to use the current random number once you start the program. Use the (N)EW option only if you wish to control the results for some reason, or when the program is first placed in the computer.

Because of your computer's limited memory there are no built-in error traps to prevent you from making errors. You must answer with the single letter inside the parentheses as shown. If you make an error, the computer assumes you selected the (R)UN option and starts a new cycle.

If you selected the (N)EW option by typing N ENTER you will see:

SEED NUMBER?

A seed number is needed to start your random number generator. Selecting a small number will create a potential start up problem. The first few numbers

generated will be zeros. To avoid this select a number seven digits long. Type 1111111 ENTER as your answer to the above question to duplicate our results.

The next question is:

NUMBER OF ITEMS?

There is no limit to how many items you wish flashed on the screen. It is suggested you start with a small number when used as a child's game so as not to lose the child's attention. When used as an inspection experiment you want to have at least 100 items flashed, so some fatigue factor enters into the inspection process. One concept the program can be used to demonstrate, is the boring nature of 100% inspection and the possible errors which occur. It is normal for individuals to count good items as bad, as well as bad items as good. For the sample run let's run 25 numbers. Type 25 ENTER to proceed to the next question:

LSL/USL?

LSL stands for lower specification limit and USL stands for upper specification limit. In the case of a child, if you wish them to count the number of two digits the lower specification limit would be 10, the smallest two digit number, and the upper specification limit would be 99, the largest two digit number. Let's use these limits for our experiment. Type 10 ENTER, and for the next question mark do as follows:

? 99 ENTER

Take care to notice the LSL is the lower limit of the items being counted by the computer, and USL is the upper limit of the items. This way of thinking may not be consistent with the manner in which you specify the limits of quality of parts. It is convenient to use this approach in the program.

The computer now flashes 25 numbers on the display. Count the numbers between 10 and 99 inclusive with care. When the computer is finished you will see the instruction:

ENTER FOR COUNT?

After you have pressed the ENTER key you should see:

DEFECTIVES 3

If your computer happens to return to the first menu without stopping (this seems to happen to us often) you can still obtain the same results. Press the BREAK key and type R. 40 and you will see the results indicated above, or type Q ENTER and the value 3 will appear on the screen.

EXAMINING THE PROGRAM

This program is relatively short. Only 13 lines of code were needed to complete the routine. Following is a list of the variables have been used in this program:

Variable	Use
A\$	To direct the flow from the first menu
A	As a counter in FOR/NEXT statement
B	The random seed number
C	The number of numbers to be flashed on display
D	The lower specification limit.
E	The upper specification limit.
F	The number flashed on the screen.
Q	A counter for number of defective items.
Z	A dummy to use to stop the program.

The letter A has two uses. Its first use is in the main menu. Once this use is complete the letter is reused for a counter in the FOR/NEXT loop producing the numbers on the display.

The program may be divided into three parts. Part I consists of lines 1, 2, 3, and 4. Line one prints the title of the program on the display and then uses an INPUT statement to route the program to either start (N)EW, or to make a (R)UN.

Line 2 inputs a new seed number if the player tells the computer to start new. The seed number is multiplied by 100,000 and then made into a postive number in line 2. This aids in getting the random number generator started just in case the player selected a small number.

Line 3 is used to select the number of items to be flashed on the display. There is no limit on this variable. Line 4 inputs the lower and upper specification limits. Careful selection of these limits will result in games or experiments for different purposes.

Part II of the program is contained in lines 14 through 20. This code prints the random number on the display and counts, using the variable Q, the number of numbers between the lower and upper specification limits. If you wish to change the size of the random number being produced, you need only change the value which is divided into B in line 17. In line 7 the value of B is divided by 100,000 and changed to an integer to yield a number between 0 and 999 inclusive.

In line 18 the number of numbers falling between the lower specification limit and the upper specification are counted. Notice the number between the limits are counted not the number outside the limits!

The next part of the program consists of lines 30 and 40. This code is used delay the program and to print the number of items inside the specification limits.

PROGRAM LISTING

```

1:PAUSE "INSPECTION EXPERIMENT":INPUT "(N)EW (R)UN ?" ;A$
2:IF A$="N" INPUT "SEED NUMBER?";B:B=1015*ABS (B)
3:INPUT "NUMBER OF ITEMS ";C
4:INPUT "LSL/USL ?";D,E
14:Q=0
15:FOR A=1 TO C
16:B=23B-INT (23B/(1018+1))*(1018+1)
17:F=INT (B/(1015))
18:IF F<=DIF F <= E LET Q=Q+1
19:PAUSE " ";F
20:NEXT A
30:INPUT "ENTER FOR COUNT ?";Z
40:PRINT "DEFECTIVES ";Q:GOTO 1

```

SUMMARY

This program can be used both as an industrial experiment or as a game. It is useful for illustrating the problems associated with 100% inspection, or to aid a child in learning numbers.

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ASK RICHARD

continued from page 29

the screen (as with a teletype terminal that can only print a continuous stream of characters on paper).

I've been told that the CP/M operating system is supposed to run on just about any microcomputer, and that this is why programs written for CP/M will also run on any computer. But then someone else told me that there's a different version of CP/M for every machine. How can this be if its supposed to be the same system on all computers?

The CP/M operating system is supplied in a different version for every CP/M computer. It has to be different for every computer, because the hardware (the microprocessor and its supporting circuitry, and the machine's peripheral equipment) is different on each computer. When two computers use different processors, the "machine language" used by the two machines is different. The different versions of CP/M are written in the native machine language for each computer.

Put very simply, when you run the CP/M operating system on different computers, it makes them all act as if they were the same kind of computer—CP/M essentially acts as a "translator" between the machine itself and higher level languages such as MBASIC. A computer which is equipped with its own version of CP/M (and the MBASIC language) can then run any program written in MBASIC, no matter what computer the program was originally written for. A computer running CP/M "emulates", or mimics, all other computers that use CP/M.

Very often I've been told that I should purchase MBASIC to run a particular program. What is MBASIC, and why must I purchase it?

MBASIC is a version of the BASIC programming language written by Microsoft, Inc. Microsoft has become more or less an "industry standard," since they wrote the first (and most popular) commercial version of BASIC for microcomputers. MBASIC is Microsoft's BASIC which is designed to run on CP/M computers.

Because of the way in which MBASIC works, you need to have MBASIC present in your computer not only to write an MBASIC program, but also when you

run the program. Many commercial software programs are written in MBASIC because MBASIC allows easy corrections and updates, and also because many users of mass-marketed software like to be able to modify and customize programs for their specific needs. If a program is written in machine language instead of a language like MBASIC, modifications become extremely difficult, if not impossible.

What do "ASCII" and "EBCDIC" stand for?

ASCII (American Standard Code for Information Interchange) and EBCDIC (Extended Binary Coded Decimal Interchange Code) are two codes for representing data in a computer. EBCDIC is used mainly in large mainframe IBM computers. All present microcomputers use the ASCII code, in which every character is assigned a decimal number from 1 to 127. 95 of these characters are more or less standard among all computers (all 52 upper and lower case letters, numbers, and certain punctuation and special symbols). This standardization is what enables computers built by different manufacturers to "talk" with each other, and to use the same standard printers.

What is a "diskette emulator"?

A diskette emulator is a device (sometimes called a "SEMIDISK" or "RAMDISK"), usually available as a circuit board which is installed in a computer, which can hold a very large amount of information in RAM memory. When such a device is installed, it is usually designed so that it uses exactly the same commands to store and retrieve information as those used for floppy diskette drives. The result is tremendously decreased access time when using the emulator instead of a diskette drive.

Diskette emulators are available for many different computers. Their price is generally in the \$500 to \$2000 range.

I'm currently shopping around for a printer and, frankly, I'm confused by so many specifications. To begin with, should I buy a dot matrix or a letter quality printer?

Letter quality printers produce printed copy as good as (or better than) a typewriter's output. Unfortunately, they are expensive and relatively slow—from about 10 to 55 cps (characters per second).

Dot-matrix printers have letters formed by dots arranged in a grid, or matrix. Many people feel that output from this type of printer is unacceptable for business correspondence. However, dot-matrix printers are usually much faster than letter quality printers (often 120 cps or more), and they are also much more inexpensive.

What is a bi-directional printer?

A bi-directional printer prints from left to right on one line, then on the next line, prints backwards from right to left. Since time which would normally be spent returning the print head to the beginning of the line is saved, bi-directionality is a speed-increasing feature.

What is the difference between bi-directionality and logic seeking?

A bi-directional printer alternates printing lines forwards and backwards. A logic-seeking printer, on the other hand, calculates the direction to print which would require the shortest traveling distance for the print head.

If a line printed from left to right only contained 5 characters, the printer would return the print head to the left and print from left to right instead of moving the print head over all the way to the right side of the paper first. Very often, a printer which is bi-directional will be logic-seeking as well.

What are proportional spacing and justification?

A proportionally-spaced character set is one in which different characters are different widths, depending upon their actual size. For example, a lower-case letter "i" takes up far less space than a capital "M". Proportionally-spaced printing resembles typesetting and appears more pleasing to the eye.

Justification (sometimes called "right-justification" refers to adding spaces in a printed line in order to line up both left and right margins exactly. For example, newspapers are always right-justified; the right margin always ends exactly at the same point due to small amounts of space added in between words, and sometimes between the letters in each word.

What width of paper should my printer be able to handle?

This is a very common question among new computer owners, and it illustrates a quite prevalent misconception. The width of the paper that your printer uses may have nothing to do with the number of characters that may be printed on each line, since different printers will print varying numbers of characters per line, and many dot-matrix printers allow you to select several different sizes of characters.

Then how many characters should my printer print on each line?

Some printers are available which only print 40 characters per line. I do not recommend purchasing these, since little software is available for such a printer.

An 80-character printer is the smallest line width for practical use. Much business software is designed for such a configuration, and a compressed printing mode (which will print 132 characters per line, in small type) is usually available for printing larger reports on dot-matrix printers.

For serious work, I recommend purchasing a 132-character printer. That is, if you plan to run your business with your computer or to generate large amounts of printed reports, 132 characters per line are usually required.

But didn't you just say that an 80-column printer with a compressed printing mode can print 132-columns?

Yes, but if you plan to use your printer for serious applications, it is usually worth the additional expense to purchase a full 132-character printer. In order to activate the compressed printing mode, a short command must be given to the computer, but sometimes this command cannot be given to the printer when using a commercially sold program.

Questions from readers on all aspects of personal computing are welcomed. Please enclose a self-addressed, stamped envelope with your request.

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BEGINNER'S CORNER

Spencer Koenig

Some not-so-BASIC Editor Functions

If you've stuck with me so far, you'll remember we've been going over the various edit functions for several of the most popular Disk Operating Systems (DOSs). Last time I was just getting into MULTIDOS. This is a very interesting operating system in that it has some edit functions similar to those I've seen on mainframe editor packages (I've worked with WYLBUR on the New York City University IBM 360/370 system).

Just as an aside, I found working with WYLBUR a little mind boggling. It's such a huge program with so many options that it can be inhibiting to try to accomplish the simplest of commands. The manual, covering the edit functions as well as information on the operating system itself, must weigh 10 pounds plus. It's really immense.

MULTIDOS isn't as large or difficult to work with, but it does have an option similar to one of WYLBUR's (and yes, there is an ORVYL too). MULTIDOS has an option called GLOBAL EDITS. The global editing feature allows you to make changes throughout the whole program with one command. You can change variable names, integers, strings, and items contained in a data list. You can also compress strings, split lines or merge them, and change "reserved" words. See EXAMPLE 9.

EXAMPLE 9

MULTIDOS Global Edit Commands

-<ENTER> Enter Global Edit Mode

Once you're in Global Edit Mode, a message will appear which will ask you for the Target and line number. See EXAMPLE 10.

EXAMPLE 10

Line	Target	REPLACED BY
	T =	R =

In order to change any of the items mentioned above, you enter the name or label, which can be as many as 255 characters long. The item, however cannot be contained in quotes. If you look at EXAMPLE 11 you can see a list of the types of changes possible using MULTIDOS. It looks pretty incredible.

EXAMPLE 11

Changes available under Global Edit

Variables 1-255 characters ending with <ENTER>

Letters in quotes precede the item with a " \$ " sign

Changing the first letter of multi-lettered variables enter the target character like this X' as X,X1,XRAY. It must be followed by a single quote

To change the second character leaving the first alone. enter the target character enclosed in single quotes 'X'

(Notice: Lower case is not acceptable for variables or reserved words.)

To change reserved words or using arithmetic operators or any of the control codes

Changing "RUN" to -RUN you must use "<" and ">" to bracket the target item

Merging adjacent line numbers

Lines can only be merged to the lines after them i.e. line 1 and 2 become line 1. Answer the TARGET question with a "/" and the line # to be appended to.

Splitting lines

Lines can only be split into consecutive lines else run time errors will occur when references to lines in between the split lines occur. The in between lines will not be found.

To use the split function answer the TARGET query with -###. -### is the word to be split. If the target is a reserved word then bracket it with "<" ">". If no target is specified then the line will split at the first colon encountered giving you line 1 and line 2.

Splitting lines can be hazardous. I suggest you look at EXAMPLE 12.

EXAMPLE 12

The splitting of lines:

10 PRINT"HELLO":PRINT"BYE"

T=-,LINE A= 10, LINE B= 20

The resulting lines look like this:

10 PRINT"HELLO"
20 PRINT"BYE"

Splitting lines at reserved words:

10 A\$="HELLO":B\$="BYE":PRINT A\$:PRINT B\$

T=-<PRINT> B\$, LINE A=10. LINE B=20

Leaving the results:

10 A\$="HELLO":B\$="BYE"
20 PRINT B\$

Once you have entered in the TARGET, you will be asked to enter the range of lines within which to search. Afterwards you will enter in the REPLACEMENT. If by chance you made a mistake in the TARGET, simply hit the <ENTER> key in answer to the replacement question. This will return you to the TARGET query whereby you use the SHIFT+@ keys to delete the TARGET and then enter in a new one.

When you've passed this stage you will go on to the next (Thanks for that piece of info) where you will be asked (one more time) if you are sure you want these changes made (Y/N). This is also the last chance to correct any errors, so you'd better be sure. If you answer "Y," the fun begins, and you begin to see the changes take place under the title lines:

LINE	TARGET	REPLACE.
------	--------	----------

To break out of the Global Edit mode, hit <ENTER> after a successful change or <BREAK> at any of the prompts, and that about covers the subject as it relates to specific editor in some typical and well conceived operating systems (thank you Howard Cosell). Right? Wrong, keyboard breath (I like Hill Street Blues).

Now we get to the topic that I've been building up to for so long. Can you use an ordinary and/or not so ordinary word processor to do some of the same work more efficiently, less dangerously, and (sometimes) with less muss and fuss? Good question! The answer is a definite MAYBE, depending on circumstances and what you want to do.

Most of the things that your specific operating system BASIC can do can be done using a word processor as long as there is good planning and careful consideration before, during and after program coding. First, let's look at the the can's and can't's of using a word processor. See EXAMPLE 13.

EXAMPLE 13

COMMANDS	BASIC	WORD PROCESSOR
1.AUTO	YES	NO
2.RENUM ENTIRE PROGRAM	YES	NO
3.WORKS WITH NON-ASCII FILE	YES	NO
4.LIST SPECIFIC LINES (TOP OR LAST OR IN BETWEEN)	YES	YES (USING 'FIND STRING')
5.PAGE COMMAND	YES	SOME
6.USES LABELS WITH LINE NUMBERS	NO	YES (BUT MUST BE DELETED BEFORE RUNNING THE PROGRAM
7.MOVE BLOCK	SOME DO	YES (COPIED NOT RENUMBERED)
8.RELOCATE LINES OR BLOCKS	SOME DO	CAN BE COAXED SEE TEXT
9.MERGING LINES	SOME	YES

10.MERGING PROGRAMS	YES	YES
11.GLOBAL VARIABLE EDITS	SOME	YES
12.CHANGING CHARACTER	YES	YES
13.CHANGE STRING TO NEW STRING	SOME	YES
14.INSERT CHARACTER	YES	YES
15.EXTEND LINE	YES	YES
16.SCROLL DISPLAY BY LINE	YES	YES
17.SCROLL DISPLAY BY PAGE	NO	SOME DO
18.FIND STRING	SOME	YES
19.MACRO (BLOCK) DELETE	YES	YES
20.RANGE-OF-LINE DELETE	YES	SEE BLOCK DELETE
21.REDEFINE KEYS	NO	NO
22 BASIC LINES LONGER THAN 255 CHARACTERS	NO	YES (YOU SHOULD BE CAREFUL WITH THIS BECAUSE IT WILL RESULT IN ERRORS)

The next to last command is often found in those BASIC EDITORS, such as XBE/CMD from Computer Applications Unlimited or IRV from Creative Software. Sometimes these types of editors also let you add graphics to BASIC programs more easily.

OK. Now that we're past the comparison stage and you see what can't be done (easily), let's get down to work. The object of this adventure is to find a way to get around the limitations of the word processor and to make those commands that BASIC can do work with us.

To begin, the word processor I use is Electric Pencil. It produces an ASCII file without any additional appendages for any printers unless you want them. It isn't as fancy as some of the others around, such as Lazy Writer or Scribes, but it is easy to use and manipulate. I mention this because I intend to give my famous short cuts and suggestions as if you too were using Pencil. If you are using those other guys, then you may have to make some adjustments to my instructions.

How, then, do we get around the limitations of commands 1-3? To get around the AUTO command, we have to create a file that contains nothing but line numbers. You do this when in BASIC by typing "AUTO" (big help huh) and putting a " " or REM marker on each line. You then save the file in ASCII format.

This brings us to command 3. Can we use a file other than an ASCII file? The answer is no, because word processors are essentially fancy string handlers. If a file isn't in STRING/ASCII format, then the word processor can't read it. The reason the E.P. can't read it is because it looks for an end-of-file marker that consists of two

zeros (00). Once it finds these it stops loading the file. If a file is saved in its normal "BINARY" format, it then consists of a bunch of 1's and 0's. The chances are good that there will be many many double 1's and especially double 0's.

Command 2 is no real problem. W.P.'s just can't renumber lines either. I suggest that if you need to renumber a program you do it in BASIC. It's a lot easier.

Commands 4 and 6, listing specific lines and/or using labels are, as I see it, related techniques. Here's why. When you're programming, it's a good idea to program in a modular fashion. By this, I mean that your program should be broken down into smaller sections that do some simple part of the overall task. Some texts refer to this as TOP DOWN programming. If you think this way when you're working, then you can give each section a specific and unique name or LABEL. Once you've assigned a LABEL to the section of code, you can find it again very easily using the W.P.'s FIND STRING command. See EXAMPLE 14.

EXAMPLE 14

I suggest you put the labels in front of the line number.

```
5' INITIALIZE
10 DEFINT A-Z
20 PRINT "HI THERE "

25' SECOND SECTION
```

After naming the section INITIALIZE, it then becomes very easy for Electric Pencil to find it again. This same technique can be used as well with specific lines, variables or variable strings.

One of the best techniques to learn is choosing your variable names carefully. If this is planned from the outset, then changing them globally becomes a minor problem. See EXAMPLE 15.

EXAMPLE 15

```
5' INPUT SCORES
10 DIM TS(151)' test scores
20 AV=0 ' AVERAGE
30 FOR SC = 1 TO 150 ' 150 SCORES TO BE INPUT
40 INPUT " INPUT THE TEST SCORES PLEASE "; TS(SC)
50 NEXT
60'
65' OUTPUT AVERAGE
70 FOR SC=1 TO 150
80 TS(0)=TS(0)+TS(SC)' THE NEXT SCORE IS ADDED TO THE PREVIOUS
90 AV = TS(0)/SC ' AND THEN DIVIDED BY THE NUMBER OF SCORES
100 PRINT AV
110 NEXT
```

Now, if I wanted to modify the name of AVERAGE to AS, the task would be greatly simplified, because AV is a unique variable that is easily read, understood, and found. I realize that this is a simple example, but I'm sure you can imagine how much easier life would be even as the programs become more complex.

What's required is to tell the W.P. to "FIND and REPLACE AV with AS" for as many times as it occurs in the program. The same kind of thing can be done for any string within the program as long as it's unique and the command is given correctly. By this I mean that you have to be sure you define the string you want changed, correctly. If you want to change AV and there is another AV within another string ("WAVE") and you specified it to Electric Pencil as FIND AV instead of FIND " AV ", you will have some problems. Remember, the space is a delimiter that must be specified.

The next thing that W.P.'s are good for is block deletes. You can specify a block to be deleted quite easily. The same holds true for block moves. What isn't done easily is renumbering the block of code. See EXAMPLE 16.

EXAMPLE 16

HAVE	WANT
10 GOTO 10	60 GOTO 60
20 GOTO 20	70 GOTO 70
30 GOTO 30	80 GOTO 80
40 GOTO 40	90 GOTO 90

What we have is in column 1 labeled "HAVE" (clever huh?), and you can guess the rest. How do we go about this? Step 1 is to use the copy command in Electric Pencil to the new location. We then must place the cursor in front of each string and tell Electric Pencil to REPLACE 10 with 60 2 times and the same for 70 and 80 etc. I admit this must seem to be the second hardest way to accomplish this task, next to retyping the lines, but if you don't have a RENUM program it will make things go a little easier.

A suggestion by a new friend of mine can make this kind of problem easier. He suggested that if you number your modules with the first character alphabetic followed by the usual numeric sequence. See EXAMPLE 17.

EXAMPLE 17

```
A100 'THIS IS THE FIRST LINE OF THE FIRST MODULE
A110 'THIS IS THE SECOND
A120 'GUESS YOU CAN FIGURE OUT WHICH THIS IS

B100 'THIS IS THE FIRST LINE OF THE SECOND MODULE
B110 'THIS IS THE SECOND OF THE SECOND
B120 'THIS IS THE THIRD
```

When you want to relocate this section of code, all you have to do is find and replace "A", for example with "1" or "2" or whatever digit places the code correctly. Thanks, Jules Greenstein, where ever you are.

Merging lines is very easy. All you have to do is to delete the line numbers of the lines you'll be getting rid of, and then get rid of the carriage return of the line before it. See EXAMPLE 18

(see top of next column)

The problem of merging programs is our old friend RENUM. I suggest that you renumber one of the files you want merged prior to merging. Number it so that there are no conflicts between the two programs. Once

EXAMPLE 18

10 'this is line 10
20 'this is line 20

- 1- delete "20"
- 2- replace the <CR> at the end of line 10 with a " : "

This will leave you with:

10' this is line 10 : this is line 20

this is done, save them as ASCII files, and then simply load them into the W.P. buffers and save them together as one file.

Well, that about covers the subject. I admit it isn't perfect, and unless you want to spend some more "dough" on another utility, I suggest you consider this alternative.

Until next time, keep your 80 happy and well fed.

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PRACTICAL BUSINESS PROGRAMS

continued from page 27

```
160 GOTO 270
170 IF LC$="Y" THEN CMD"FORMS(T)"
180 LPRINT "BALANCE SHEET":SS#=0: SX#=0: OPEN"I",1,FF$:WS$="NO
      ACCOUNT      DEBIT      CREDIT": LPRINT WS$
190 FOR I=1 TO SU: INPUT #1,A$: IF I<Z1 OR I>Z3 THEN LPRINT
      USING E$;I,A$,X$(I,1),X$(I,2)
200 SS#=SS#+X$(I,1):SX#=SX#+X$(I,2): NEXT I
210 LPRINT S$
220 LPRINT USING XG$;SS$,SX$: LPRINT XX$
230 CLOSE 1: OPEN"O",1,NQ$: FOR I=1 TO SU: FOR Q=1 TO 2:
      RO#=INT(X$(I,Q)*100)/100:DI#=X$(I,Q)-RO#:X$(I,Q)=RO#: IF
      DI#>.005 THEN X$(I,Q)=X$(I,Q)+.01
240 PRINT #1,X$(I,Q);
250 NEXT Q
260 NEXT I: CLOSE 1: LOAD "GLMENU",R:REM INPUT TO DISK
270 Z1=N(1)+N(2):Z2=Z1+N(3):Z3=Z2+N(4):Z1=Z1+1
280 FOR I=1 TO SU: IF X$(I,1)>X$(I,2) THEN LET X$(I,1)=
      X$(I,1)-X$(I,2):X$(I,2)=0
290 IF X$(I,1)<=X$(I,2) THEN LET X$(I,2)=X$(I,2)-X$(I,1):
      X$(I,1)=0
300 NEXT I
310 SA#=0:CC#=0
320 FOR I=Z1 TO Z2:SA#=SA#+X$(I,2)-X$(I,1): NEXT I
330 FOR I=Z2+1 TO Z3:CC#=CC#+X$(I,1)-X$(I,2): NEXT I
340 B$="          PROFIT & LOSS": C$="          PRESENT
      YEAR TO DATE"
350 D$="          AMOUNT  PERCENT  AMOUNT
      PERCENT"
360 H$="### %          % ###.###.## #.## ###.###.##
      #.##": LPRINT B$
370 LPRINT C$: LPRINT D$
380 SS#=0: SX#=0: OPEN"I",1,NP$
```

```
390 FOR I=Z1 TO Z3: INPUT #1,A#,B#: S$(I,1)=A#+X$(I,1):
      S$(I,2)=B#+X$(I,2):SS#=SS#+S$(I,1):SX#=SX#+S$(I,2): NEXT
      I: CLOSE 1
400 OPEN"O",1,NZ$: FOR I=Z1 TO Z3: FOR Q=1 TO 2:
      RO#=INT(S$(I,Q)*100)/100:DI#=S$(I,Q)-RO#:S$(I,Q)=RO#: IF
      DI#>.005 THEN S$(I,Q)=S$(I,Q)+.01
410 PRINT #1,S$(I,Q);
420 NEXT Q: NEXT I: CLOSE 1
430 FOR I=Z1 TO Z2: IF SA#>0 THEN QP(I)=X$(I,2)/SA#
440 IF SX#>0 THEN QQ(I)=S$(I,2)/SX#
450 NEXT I
460 FOR I=Z2+1 TO Z3: IF CC#>0 THEN QP(I)=X$(I,1)/CC#
470 IF SS#>0 THEN QQ(I)=S$(I,1)/SS#
480 NEXT I
490 OPEN"I",1,FF$: FOR I=1 TO Z1-1: INPUT #1,A$: NEXT I
500 FF#=0:SD#=0: FOR I=Z1 TO Z2: FF#=FF#+S$(I,2):
      SD#=SD#+X$(I,2)
510 INPUT #1,A$: IF X$(I,2)>0 THEN LPRINT USING H$;I,A$,
      X$(I,2),QP(I),S$(I,2),QQ(I) ELSE S$(I,2)=S$(I,2)-X$(I,1):
      LPRINT USING H$;I,A$, -X$(I,1),QP(I),S$(I,2),QQ(I)
520 NEXT I: LPRINT USING H$;0,"TOTAL SALES",SD#,1.,FF#,1.:
      LPRINT" "
530 FOR I=Z2+1 TO Z3: INPUT #1,A$: IF X$(I,1)>0 THEN LPRINT
      USING H$;I,A$,X$(I,1),QP(I),S$(I,1),QQ(I) ELSE S$(I,1)=
      S$(I,1)-X$(I,2): LPRINT USING H$;I,A$, -X$(I,2),QP(I),
      S$(I,1),QQ(I)
540 NEXT I
550 PR#=SA#-CC#: S$="          -----
      -----": LPRINT S$
560 XG$="          ##.###.###.##
      ##.###.###.##"
570 PS#=SX#-SS#: LPRINT USING XG$;PR#,PS#
580 XX$="          =====
      =====": LPRINT XX$
590 CLOSE 1: FOR I=Z1 TO Z3: X$(I,1)=0: X$(I,2)=0: NEXT I:
      IF PR#>0 THEN LET X$(SU,2)=X$(SU,2)+PR#
600 IF PR#<0 THEN X$(SU,1)=X$(SU,1)-PR#
610 IF X$(SU,1)>X$(SU,2) THEN LET X$(SU,1)=X$(SU,1)-X$(SU,2):
      X$(SU,2)=0
620 IF X$(SU,2)>=X$(SU,1) THEN LET X$(SU,2)=X$(SU,2)-X$(SU,1):
      X$(SU,1)=0
630 GOTO 170
```

SUMMARY

The CPA program reviewed is the second program in group 2. This program produces a profit and loss statement and a balance sheet. With this new program added to the ones already available you can set up your chart of accounts, input your transactions, and produce a periodic set of accounting reports.

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PRODUCT REVIEW: CASSETTE ENHANCEMENTS

LEMONS TECH SERVICES

KWIK SOFTWARE

Richard Kaplan

When the owner of an overworked cassette system considers purchasing a mass-storage device for his computer, the possibilities are enormous. Aside from the classic diskette drive, there are companies which promote stringy floppies, hard disk drives, tape drives (such as those used with mainframe computers), and even an 8-track cartridge drive to store programs. Unfortunately, each of these systems has one significant drawback: cost. Lemons Tech Services and Kwik Software each offer a unique alternative; a "cassette loader" for \$17.99 to increase cassette reliability and a "cassette operating system" for \$26 which can decrease loading time by as much as a factor of 6.

Lemons Tech Services manufactures hardware enhancements for cassette owners; Kwik Software develops software. Although each company actively promotes the other's product and the software and hardware do complement each other, either product may be used independently. Thus, let's first examine the hardware aspect of this unique cassette enhancement.

THE LEMONS TECH LOADER

Lemons Tech offers a variety of loaders, varying in price from \$17.99 to \$29.99. Models are available which can run on either the Model I or Model III (although a switch may need to be activated for Model III operation at high baud).

Essentially a cassette loader is a "black box" which eliminates the guesswork in setting the volume level when loading programs from cassette. The Lemons Tech loaders are designed to operate with the cassette volume level set at the highest setting. The loader's circuitry monitors the volume level for you.

Setting It Up

Installing the loader is quite simple. The cassette cable plug which normally is inserted in the "ear" jack should be inserted into the loader; a wire attached to the loader itself plugs into the cassette recorder's ear jack. Once the volume level is adjusted to its highest setting, the computer operator need not know the loader is even set up. No batteries or external power is needed.

(NOTE: The loader's instructions make a point of the fact that the loader is designed for the Radio Shack CTR80 or CTR80A. Resistors are provided for modifying the CTR41 or CCR81, a modification which requires opening these recorders and soldering in new resistors. The loader may not function with other cassette recorders.)

What Does It Do?

The loader by itself does *not* increase program loading speed. Instead, it is designed as a stand-alone product which increases cassette reliability. Difficulties

with volume settings and poor reproduction quality are greatly diminished. In addition, a jack for a speaker or earphone is provided to listen to program saves or loads without pulling plugs from the cassette recorder.

OPTIONAL FEATURES

A number of optional features are available for a quite nominal cost. For \$19.99 (\$2 above the standard MODEL LC), the MODEL LCM includes a built-in audio monitor for listening to program saves/loads without a speaker or earphone. Other models include a volume control and/or an audio monitor. Finally, the "top-of-the-line" MODEL LLQ-2MC has an output jack for copying tapes from one recorder to another.

Another Hardware Addition

Another standalone product available as a cassette enhancement is the SOFTROL SOFT SWITCH for \$18.99. This device has two primary functions: (1) An override switch enables free tape positioning without pulling plugs from your cassette recorder; (2) A delayed motor-off feature automatically places gaps between your programs, allowing for easier program location and a lessened chance of data being damaged at the end of a program when the motor is turned off.

An Analysis of Lemons Tech

Lemons Tech hardware appears to be very reliable, and it has a price which can't be beat. The instructions provided clearly indicate the manufacturer's competency in the area of cassette storage, noting subtle differences in the operation of the various Radio Shack cassette recorders. (Did you know the CTR80 and 80A allow you to rewind or fast-forward a tape while hooked up to a computer, while the CTR41 does not?) In short, Lemons Tech loaders are highly recommended to any cassette owner who has ever experienced loading difficulties.

THE KWIK SOFTWARE "OPERATING SYSTEM"

The heart of the KWIK Software offerings appears to be the cassette operating system. Actually, there are two different operating systems—KOS3 for the Model III and KWICOS for the Model I. These operating systems can improve cassette loading time as much as 6X, and they add many disk-like commands to cassette BASIC.

Running The Program

KWICOS and KOS3 are machine-language programs which occupy 1700 bytes of memory. Program loading instructions are quite explicit, and a friendly but stern warning message warns the user the the program is

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BOOK REVIEW

Learning TRS-80 BASIC

for the Models I, II/16, and III by David A. Lien

Spencer Koenig

Learning TRS-80 BASIC is 544 pages long and is by far one of the most useful and well written books for the TRS-80 I've had the pleasure to read. I suggest that if your or your child's school is in need of a well conceived and presented text for the Junior High to High school level (and beyond), then urge them to get this one. Now that you know my opinion on Mr. Lien's book, let me tell you a little about him and the book and why I feel this way.

If you have been involved with the TRS-80 for a little while, then the name David Lien should not be new to you. He wrote the "original Level I manual." The Level I manual set a standard for technical manuals. This standard said that they should be clear, be fun, and most of all be understandable.

This new book, *Learning TRS-80 BASIC* contains lots of fun cartoons that illustrate and point out myths and mistakes to watch out for that every beginner might make or misunderstand. It is by this low humor that it overcomes any computer phobia that the learner could have. This is especially important for the adults working with a computer for the first time. I say this about adults, because the fact is that I have not yet met a child or teenager who couldn't wait to get his hands on one of these amazing imagination machines. They run towards them without any reservations or fears.

Though it is a book on a technical subject, it is still a very entertaining and educational book, for the layman/beginner, on using the TRS-80 and learning BASIC. I am very happy to see that Mr. Lien hasn't abandoned the approach that, after all, made him famous. The fact that he hand holds the reader step by step from the very early stages of computing to the mid-intermediate stages, and does it so well, illustrates his talents as a teacher and writer.

The book is broken down into 5 sections (A through E). Section A is in 8 parts, followed by 4 secondary sections (B through E). In SECTION D we have 8 appendices and in SECTION E we have the INDEX that I wish could have been a part of the original documentation that came with the Model I, way back when. It's this kind of consideration that permeates this book and that makes it a cut above the rest.

Within the 8 major sections, the book is further broken down into 50 much smaller chapters. I like the fact that the chapters are so small because this allows the reader to progress at his or her own pace and not feel that there is too much information to "overcome" in order to get to the end of a chapter. Mental fatigue is a big problem, and this is generally the problem of many textbooks on the subject.

Many times assumptions are made about what the reader knows, and this leads to problems and frustrations. *Learning TRS-80 BASIC* gets around this by having all the information there in these small chapters, and it includes limited problems to solve as you go along, reviewing the material covered. Not only could

you learn a great deal about BASIC from this text, but you could also learn quite a bit about teaching as well. This is important for parents, who need a text to help them help their younger children to learn computing. It can't be said about many texts I've come across.

Now for the *tour de force*. Perhaps the most important fact about this book is that it teaches about all of the Tandy machines available at the time of this writing (there are always rumors). The text also contains most of the documentation you'll need to do anything on these machines. The indices are what we've been waiting for from Tandy for a long, long time. Now we finally have them for each of the machines, and in one place.

In section A, part I, we have chapters 1-4. The smallest chapter is 6 pages and the largest is 10. In fact, the largest chapter I could find (at a glance) was about 13 pages in length. This is a good guide to follow for young readers and phobia prone adults. Keep them short and keep them happy ("them" refers to different "them"s for those who are paranoid).

The subject is taken from the very beginning, starting with turning the computer ON. This section is called COMPUTER ETIQUETTE. It is here that you first come across one of the things I don't like about the book. In trying to cover so much material, Mr. Lien has come up with a novel approach, which I think is a good idea but difficult to do successfully because it is a compromise.

He explains Level II from the point of view of the Model III, which is fine, but in the right margins he inserts any differences to the Model I and the Model II/16, as well as additional information that may be relevant but better introduced as an aside. There are times when all this information becomes confusing and distracting. The text in these margins is also much smaller than the regular text by necessity and therefore harder to read, even though great care was taken in the layout to keep the pages as uncluttered as possible.

Although I recommend this book as a general text for Junior High School and up, I wish there were a larger format available for students (and for me too) that would be easier on the eyes and less constrained on the page.

Meanwhile, back in the chapter, we find that in a few short pages we've had a number of simple examples, 4 new commands, 1 statement, and some miscellaneous information.

Chapter 2, entitled "Expanded Program," does just that. A few more commands, statements and general information lead us to chapter 3, which covers the "EDITOR-First Semester." The pace for introduction of material is very natural and seems to come up quite conversationally. Buzzwords are not overlooked and are explained when encountered. I can't tell you how often I've found texts that explain a subject without explaining some of the language necessary to understand what the author is explaining.

PART II, Chapters 5-8, covers what is perhaps the root of computer phobia, "Math Operators" in 5, "Scientific Notation" in 6, "Order of Operations" in 7 and "Relational Operators" in 8. When I started "teaching computers" in my school, the first question kids asked me was "Do I have to know MATH," and the second was "Do I have to know how to type." All I could say was "NO," because I knew they would learn what they had to know when they had to know it, and it would make the whole experience more meaningful. They might even remember something about it later.

Mr. Lien treats the subject lightly and gives short examples and a problem to solve that is related to his examples. He doesn't really go into much depth (and shouldn't), but he does cover the subject clearly and quickly. This allows the beginner to see the potential and to get onto something more interesting.

Chapters 9-11 deal with input and output via the screen, calculator and immediate mode, and last but not least, cassette and disk commands and usage. There is no real depth to these, but enough information is given to allow the beginner to work with his equipment and at least get the job done.

From chapter 12 on, we first get into the meat of real programming through "For-Next Looping" with a brief introduction to incrementing. (He uses some of his earlier math examples again to show some applications of the new command—nice touch!) Chapter 13 expands on the For-Next with four new commands (List ###, Run ###, Delete ### and Cont).

Chapter 14 picks up on the Tab (sorry) function for pretty printing to the screen, and chapter 15 again expands on the For-Next. In 15, however, we come across the first introduction of material that we call "Programming technique." Here is the first mention of considerations for making programs more readable (line indentation in loops). I don't recall seeing this concept in Mr. Lien's earlier versions (I could be wrong), but I think it's extremely important that these kinds of considerations be demonstrated to the beginner early on.

Chapter 16 covers the integer function fully. Chapter 17 talks about "More Branching Statements" used in conjunction with the earlier INT function. Here we get to see some of the more powerful commands the BASIC language has to offer. I didn't think that Mr. Lien was careful enough at this point. Introduction of GOTO's these days is a touchy subject, and more could have been said and demonstrated about careful use of these commands without going into too much detail. The concept of subroutines and "CALLS" is also discussed here in a very cursory manner.

Chapter 17 could have been called "FUN with Random," but instead it's just plain old "Random Numbers." Demonstrations of the famous game coin flip fill out this chapter.

The final chapter in section 2 covers "READING DATA." Introduced are the ideas of; how to use the READ data statement; restoring data and reading string data. Some examples show the famous OD error and what to do about it.

Section 3 begins with the often entangled subject of "STRINGS." It's at this point that the learner starts to get more involved with the examples as they get larger and more complex. Chapter 20 is entitled "Intermediate

BASIC" and re-covers most of the material already demonstrated with some new twists. Multi-statement lines, string variables, some short hand (? instead of Print) and the use of some special key to get around the keyboard are explained.

Chapter 21 covers "The Editor - Second Semester" and greatly expands on Chapter 3. At this point the user is beginning to feel like a real hacker, solving problems and getting the computer under control.

Chapters 22 and 23 start going into details of string handling, a subject that is more than just learning to use the TRS-80. ASCII is explained, and how the TRS-80 handles them is followed by "Strings in General."

Chapters 24, 25 and 26 start the real subject matter as we learn how to begin manipulating strings by taking them apart and putting them together from the beginning of the string, middle or end.

Well, by this time if you're not hooked on computing you never will be, and so it's time to start getting back into the dreaded subject of "MATH." Part 4, chapter 27 covers "what price precision?" The overhead of double precision is reviewed as is the many ways of doing similar numeric gymnastics. Introduced are the commands INT(n), FIX(n), ABS(n), LOG(n), and EXP(n). The chapter is mostly "try it and see." A little more depth is left to the last chapter of this section which include some of the TRIG functions.

Now, we finally come to the all important subject "Graphics and Display Formatting." We finally get to draw pictures using all those math routines we've had to endure. Chapter 30 discusses the video display. Chapter 31 covers line drawing using variables and introduces a little bit of animation. Chapter 33 explores the power of the Print@ function and 34 gets back to those wonderful TRIG functions I'm sure everybody skipped the first time.

Chapter 34 covers "Point," 35 covers getting a response into the computer via "INKEY\$," and applications of these two commands are combined with "PRINT USING" for those of you with business computing in mind in chapters 36 and 37.

Surprisingly, in a whole section (6) of its own, we come to a topic that is usually covered very lightly and left to the reader to fend for himself. The subject is "ARRAYS" (chapter 38), how to manipulate them ("SEARCH and SORT" in chapter 39), and then how to use multi-dimensional arrays (chapter 40).

Chapters 41 and 42 get back to the fun stuff recombining the older material for some advanced graphics techniques. Although this text isn't meant to really teach graphics, it certainly goes far to whet your appetite. There is a reference to an excellent book for graphics available at Radio Shack, cleverly entitled *TRS-80 GRAPHICS for the Model I and Model III*.

The remaining sections (7 and 8) of the book cover miscellaneous topics of using POKES and PEEKs, memory organization, logical operators and USR functions. Section 8, for me, was a pleasant surprise, because it talked about "Program Control" but really discussed programmer control. In other words, it covered techniques usually reserved to other books, flow charting, debugging techniques, and figuring out what those error messages really meant.

Section B has answers to all those problems to be solved, followed by section C, which contains a number

PIRATE SOFTWARE, HBO DISHES, OFF-THE-AIR VTR, AND OTHER ALLEGED "CRIMES" OF THE COMPUTER AGE

Mike Shadick

To hear some say it, it would seem that the age of personal computery and video is only ushering in a veritable phlange of ways to either break, bypass, or slide by the electronically foreshortened arm of the law. Yet every one of the so-called crimes referred to in this editorial's title—not to mention many others, as well—are not in the least criminal from the standpoint of crimes *only in the minds of the profiteers*.

Who are the profiteers? Those who stand to gain greatly from the very computer/video revolution they seem so staunchly to oppose! Instead of meeting the new breed of consumer in the marketplace, the profiteers appear to prefer seeing him or her in court!

In effect, the profiteers are saying (if not shouting!), "Creative use of home computery and video is dipping into our profits, and we're gonna fight it with everything we've got!"

Personally, I find it very difficult to feel any compassion for them whatsoever.

Take the issue of "illicit" software duplication (pirating). There is one sure way in which profiteering software suppliers can not only get "one up" on the pirating game, but can even beat it! And what is that one way? By making frequent *improvements* in their software prorams, thereby assuring that whomever wants the best, the latest, the most up-to-date state-of-the-art programs available, will have no choice but to buy them.

An effective solution to the pirating problem, is it not? Yet it would seem that some software suppliers would rather bellyache about what they wish was, instead of creating their own ongoing reality in the form of frequent program improvements.

Well, so much for software suppliers. Heaven knows we need them! What we *don't* need is their "victim" laments. *And neither do they.*

Now let's move right along to home microwave

of program examples to study and take apart with your new found skills.

The remaining APPENDIX's A-G are real treasures, covering the differences between the three and a half machines from DISK BASIC to ASCII characters as well as most of the various special features that each machine contains.

All in all, this is an amazing accomplishment. To have so much information so well covered certainly puts most of the texts on the same subject to shame. The fact that all of the Tandy machines are covered so well makes it three times the bargain. You can be sure that, had it been a different author with lower standard, you'd have to buy three or four books at the same price as this one to get half the information. *Learning TRS-80 BASIC for the Models I, II/16, and III* is perhaps the computer book buy of decade.

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Price: \$19.95, Available from
Compusoft Publishing, H & E
Computronics (800-431-2818),
and various computer and book
stores.

antennas—the ubiquitous rooftop or balcony dishes. To hear the Home Box Office organization and others tell it, you'd think that the dishes were driving them all to the poorhouse! In the cable profiteers' attempts to keep their signals out of unpaying hands, they're trying all sorts of signal-scrambling techniques, only to be one-upped by home dish owners who are scrambling (or should I say, *unscrambling*), even faster.

Yet it is difficult to feel any compassion for the cable companies' "plight." After all, I've yet to find it inscribed in the Good Book (or any other), "Thou shalt send thy signal via microwave, and only microwave shalt thou use." Pardon my French, but *Hell*, there are any number of ways that HBO and the other such services could be getting their signals from here to there. The fact that they've chosen to use microwave relays is certainly no valid reason to point a blaming finger at home video buffs who also enjoy receiving the microwave media.

To accuse dish owners of signal pirating, then, is a lot like faulting Ma Bell's customers for putting modems on their phones. As long as nothing is screwed up, the phone lines are for the customer's use, in any way that he or she wishes.

The same is true of dishes, or it *should* be.

One final microjab, this one levelled at the foes of home video recording. You know—the TV networks, prerecorded cassette suppliers, and others who are trying (and in some cases apparently succeeding) to make it illegal to tape copyrighted material off the air, which is just about everything on the tube.

Their courtroom antics remind one of the teetotaling bar-smashers just before the enactment of Prohibition. Do the networks and others actually believe that they can legislate home video recording out of existence? For that's the only way in which their archaic wishes could ever come true!

Here, again, the answer seems obvious. The best way for the profiteers to "beat" the home video revolution is to plunge whole hog into the business of selling blank tapes! That's where a sizable chunk of their long-term profits lie. But it seems that they'd rather just bellyache.

So as I see it, my microfriends, the burden of *proof* as to what does or does not constitute home computer/video "crimes" rests not with the alleged perpetrators, but rather with the profiteers. If they're just too lazy (or intransigent) to go with the flow and thereby *benefit* from the new tools of a new age—well, then, that's just too bad for them.

At any rate, they have no right to take *their* problems out on us. American know-how and ingenuity belongs in the plants and on the drawing boards, not in the courts.

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(Editor's note: the views expressed in this article are not necessarily those of H & E Computronics, Inc.)

SPACE X

Steve Brown

This unique game program is relatively short and with very simple modifications can run on any TRS-80. These modifications would be made on the calls to the built-in ROM routines (0060H and 01C9).

Once the game has started, erroneous data may not be entered because the input comes from the keyboard and only valid responses are checked.

The sound effects are fairly good and the graphics are excellent.

From the user's standpoint this program is very easy to use. After getting the program loaded the user presses the left arrow key to move left, the right arrow key to move right, or the space bar to fire. There are no complicated formulas to remember.

The game is tantalizing. The closer you get to winning the more difficult the game becomes. The 3 levels of difficulty and the shot counter at the end of the game allow everyone to play at a level they feel comfortable with.

PROGRAM ORGANIZATION

Basically the program consists of a control section, several major subroutines, and several minor subroutines (which may be thought of as simple functions—for example, INC40H increments the HL register pair 40H times).

USERS GUIDE

255 bombs will be spit out by the mother ship. They move horizontally until they are directly above the correct bomb "chute" then they move vertically into the bomb chute. When a bomb chute is full (contains 5 bombs) a bomb is dropped vertically. If the bomb hits your gun, the resulting explosion will destroy the planet. You may either shoot the bombs or move horizontally to avoid being hit by bombs.

UFOs will randomly appear at the far right or left side of the screen. They slowly drop vertically. If they reach the planet (the bottom of the screen) they explode and destroy the planet.

Your gun moves horizontally across the planet. To move left, press the left arrow key. The gun will continue to move left until you release the key. The right arrow key moves the gun to the right.

To fire your gun, press the space bar. The gun will continue to fire until you release the space bar. A count is kept of the number of shots fired and is displayed at the end of the game. Also the number of shots fired in the best game so far today is displayed at the end of the game.

To win the game you must shoot all 255 bombs or avoid being hit by them, and shoot all UFOs before they hit the ground.

To start the game:

- 1) Type "SYSTEM" and press ENTER
- 2) Type "SPACE X" and press ENTER
- 3) Load the tape
- 4) When the program has loaded, type "/18688" and press ENTER
- 5) Press "1" for an easy game, "2" for a medium

game, or "3" for a hard game.

In playing the game, "U" represents your gun, "*" a bomb, "%" a UFO, and the mother ship and bomb chute are shown by graphic blocks.

VARIABLES

BEST: 4 bytes—Used by NEWWIN—Fewest number of shots taken to win a game (so far today).

BOMBFL: 5 Bytes—Used by FIGMOV and FIRE—Number of moves downward before bomb reaches the bottom of the screen. Referenced after a bomb chute is full (contains 5 bombs). There are 5 bomb chutes and each byte corresponds to a bomb chute.

CURBMB: 2 bytes—Used by FIGMOV—Current bomb address (screen location).

CURCOL: 1 byte—Used by COLADD and FIGMOV—Bomb chute that the current bomb is moving to.

CURLFT: 5 bytes—Used by FIGMOV—Number of downward moves before bottom of chute is reached. There are 5 chutes and each byte corresponds to a chute.

GUNADR: 2 bytes—Used by UMOVE, FIRE, and FIGMOV—Gun address (screen location).

GUNPOS: 1 byte—Used by UMOVE and FIRE—Relative gun position left to right, greater than 0 and less than 31.

LTOGO: 1 byte—Used by FIGMOV—Number of moves to the left before the bomb will be directly above the appropriate bomb chute. This variable is loaded into LTOGOL on the first move.

LTOGOL: 1 byte—Used by FIGMOV—Value is loaded from LTOGO. Then is decremented each time the bomb moves left until it is equal to zero (at this point the bomb is directly above the appropriate bomb chute).

SHOTS: 4 bytes—Used by FIRE and NEWWIN—Number of shots fired in current game. ASCII representation of a decimal number.

TMPCOL: 1 byte—Used by FIRE—Used to retain CURCOL until it is needed by the FIRE routine.

TMLFT: 5 bytes—Used by FIGMOV—Value is loaded from CURLFT. Then is decremented each time the bomb moves downward until it is equal to zero (at this point the bomb is at the appropriate position in the chute).

UFOCTR: 1 byte—Used by RNDUFO—The RNDUFO routine is executed every eighth time it is called. This variable keeps count of how many times its been called since it was last executed.

UF1ADR: 2 bytes—Used by RNDUFO and FIRE—UFO #1 address (screen location) where UFO #1 is located.

UF1CTR: 1 byte—Used by RNDUFO—Number of downward moves before UFO #1 reaches the bottom of the screen.

UF2ADR: 2 bytes—Used by RNDUFO and FIRE—UFO #2 address (screen location) where UFO #2 is located.

UF2CTR: 1 byte—Used by RNDUFO—Number of downward moves before UFO #2 reaches the bottom of the screen.

00100	ORG	4900H	00750 L6	LD	(HL), 30H	01430	LD	(HL), 32H
00101 DELAY	EQU	0060H	00760	INC	HL	01440	INC	HL
00102 CLEAR	EQU	01C9H	00770	DJNZ	L6	01450	INC	HL
00110 BEGIN	CALL	INIT	00809	CALL	CLEAR	01460	LD	(HL), 35H
00120 MAIN	CALL	FIGMOV	00810 L7	LD	HL, EASY	01470	INC	HL
00130	CALL	FIGMOV	00812	LD	DE, 3D10H	01480	INC	HL
00140	CALL	FIGMOV	00814	LD	BC, 0008H	01490	LD	(HL), 35H
00150	CALL	FIGMOV	00816	LDIR		01500	LD	HL, 3FE0H
00160	CALL	UMOVE	00818	LD	HL, MED	01510	LD	(GUNADR), HL
00170	CALL	FIRE	00820	LD	DE, 3D50H	01520	LD	(HL), 55H
00180	CALL	RNDUFO	00822	LD	BC, 000AH	01530	RET	
00190	JP	MAIN	00824	LDIR		01540	FIGMOV LD	B, 1
00200 L1	CALL	CLEAR	00826	LD	HL, HARD	01550	CALL	DELAY
00210	CALL	NEWWIN	00828	LD	DE, 3D90H	01560	LD	A, 20H
00220	LD	HL, MSG3	00830	LD	BC, 0008H	01570	LD	(3D88H), A
00230	CALL	WORL	00832	LDIR		01580	LD	(3D90H), A
00240	LD	HL, WINMSG	00850 L8	LD	A, (3810H)	01590	LD	(3D98H), A
00250	LD	DE, 3D10H	00860	OR	A	01600	LD	(3DA0H), A
00260	LD	BC, 0018H	00870	JR	Z, L8	01610	LD	(3DA8H), A
00270	LDIR		00880	BIT	1, A	01660	LD	HL, CURLFT
00280	LD	HL, CHAMP	00890	JR	Z, L9	01670	CALL	COLADD
00290	LD	DE, 3D90H	00900	LD	HL, FIGMOV+1	01680	OR	A
00300	LD	BC, 0018H	00910	LD	(HL), 0BH	01690	JP	Z, L19
00310	LDIR		00920	LD	HL, L31+1	01700	LD	HL, LTOGOL
00320	LD	HL, RESTRT	00930	LD	(HL), 7AH	01710	LD	A, (HL)
00330	LD	DE, 3E90H	00940	LD	HL, L33+1	01720	OR	A
00340	LD	BC, 000BH	00950	LD	(HL), 6	01730	JR	Z, L13
00350	LDIR		00960	JP	L11	01740	LD	HL, (CURBMB)
00360 L2	LD	A, (3840H)	00970 L9	BIT	2, A	01750	LD	A, 28H
00370	BIT	0, A	00980	JR	Z, L10	01760	CP	L
00380	JR	Z, L2	00990	LD	HL, FIGMOV+1	01770	CALL	Z, CINTER
00390	JP	BEGIN	01000	LD	(HL), 9	01780	LD	HL, (CURBMB)
00400 L3	CALL	CLEAR	01010	LD	HL, L31+1	01790	LD	(HL), 20H
00430	LD	HL, MSG2	01020	LD	(HL), 77H	01800	DEC	HL
00440	CALL	WORL	01030	LD	HL, L33+1	01810	DEC	HL
00450	JP	BEGIN	01040	LD	(HL), 8	01820	LD	(HL), 2AH
00460 INIT	LD	HL, 3C28H	01050	JP	L11	01830	LD	(CURBMB), HL
00470	LD	(CURBMB), HL	01060 L10	BIT	3, A	01840	LD	HL, LTOGOL
00480	LD	HL, LTOGO	01070	JP	Z, L8	01850	DEC	(HL)
00490	LD	(HL), 16	01080	LD	HL, FIGMOV+1	01860	RET	
00500	INC	HL	01090	LD	(HL), 7	01870 L13	LD	HL, (CURBMB)
00510	LD	(HL), 16	01100	LD	HL, L31+1	01880	LD	A, 28H
00520	INC	HL	01110	LD	(HL), 74H	01890	CP	L
00530	LD	(HL), 0	01120	LD	HL, L33+1	01900	JR	NZ, L14
00540	INC	HL	01130	LD	(HL), 0AH	01910	LD	A, 3CH
00550	LD	B, 10	01140 L11	CALL	CLEAR	01920	CP	H
00560 L4	LD	(HL), 5	01150	LD	A, 8	01930	JR	NZ, L14
00570	INC	HL	01160	OUT	(0FFH), A	01940	CALL	CINTER
00580	DJNZ	L4	01170	LD	HL, 3C4CH	01950 L14	LD	HL, TMLFT
00590	CALL	CLEAR	01180	LD	B, 4	01960	CALL	COLADD
00600	LD	HL, GUNPOS	01190	LD	A, 0BFH	01970	OR	A
00610	LD	(HL), 16	01200 L12	PUSH	HL	01980	JR	Z, L15
00620	INC	HL	01210	POP	IX	01990	DEC	(HL)
00630	LD	(HL), 0	01220	LD	(IX+0), A	02000	LD	HL, (CURBMB)
00640	INC	HL	01230	LD	(IX+8), A	02010	LD	(HL), 20H
00650	LD	(HL), 0	01240	LD	(IX+16), A	02020	CALL	INC40H
00660	INC	HL	01250	LD	(IX+24), A	02030	LD	(HL), 2AH
00670	LD	(HL), 0	01260	CALL	INC40H	02040	LD	(CURBMB), HL
00680	LD	(HL), 4	01270	DJNZ	L12	02050	RET	
00690	LD	B, 5	01340	LD	HL, 3C2AH	02060 L15	LD	HL, 3C28H
00700 L5	LD	(HL), 8	01350	LD	(HL), 0BBH	02070	LD	(CURBMB), HL
00710	INC	HL	01360	INC	HL	02080	LD	HL, CURLFT
00720	DJNZ	L5	01370	INC	HL	02090	LD	DE, CURCOL
00730	LD	HL, SHOTS	01380	LD	(HL), 0BFH	02100	LD	A, (DE)
00740	LD	B, 4	01390	INC	HL	02110	ADD	A, L
			01400	INC	HL	02120	LD	L, A
			01410	LD	(HL), 0B7H	02130	DEC	(HL)
			01420	LD	HL, 3C3AH	02140	LD	A, (HL)

02150	CALL	INC05H	02840	LD	(HL),8	03550	RET	NZ
02160	LD	(HL),A	02850	JP	L16	03560	LD	A,(UF1CTR)
02170 L16	LD	HL,CURCOL	02860 UMOVE	LD	A,(3840H)	03570	OR	A
02180	INC	(HL)	02870	BIT	5,A	03580	RET	Z
02190	LD	A,(HL)	02880	JR	Z,L21	03590	LD	HL,UF1CTR
02210	CP	5	02890	LD	A,(GUNPOS)	03600	LD	(HL),0
02220	JR	NZ,L17	02900	OR	A	03610	LD	HL,(UF1ADR)
02230	LD	(HL),0	02910	RET	Z	03620	LD	(HL),20H
02240 L17	LD	HL,LTOGO	02920	LD	HL,GUNPOS	03630	LD	HL,0880H
02250	LD	A,(HL)	02930	DEC	(HL)	03640	CALL	SOUND
02260	OR	A	02940	LD	HL,(GUNADR)	03650	RET	
02270	JR	NZ,L18	02950	LD	(HL),20H	03660 L24	LD	A,(UF2CTR)
02280	LD	(HL),14H	02960	DEC	HL	03670	OR	A
02290 L18	DEC	(HL)	02970	DEC	HL	03680	RET	Z
02300	DEC	(HL)	02980	LD	(HL),55H	03690	LD	HL,UF2CTR
02310	DEC	(HL)	02990	LD	(GUNADR),HL	03700	LD	(HL),0
02320	DEC	(HL)	03000	RET		03710	LD	HL,(UF2ADR)
02330	LD	A,(HL)	03010 L21	BIT	6,A	03720	LD	(HL),20H
02340	INC	HL	03020	RET	Z	03730	LD	HL,0880H
02350	LD	(HL),A	03030	LD	HL,GUNPOS	03740	CALL	SOUND
02360	RET		03040	LD	A,(HL)	03750	RET	
02370 L19	LD	HL,BOMBFL	03060	CP	31	03760 L25	LD	A,(HL)
02380	CALL	COLADD	03070	RET	Z	03780	CP	20H
02390	LD	B,A	03080	INC	(HL)	03790	RET	Z
02400	LD	D,H	03090	LD	HL,(GUNADR)	03800	PUSH	HL
02410	LD	E,L	03100	LD	(HL),20H	03810	LD	HL,0104H
02420	LD	HL,3D88H	03110	INC	HL	03820	CALL	SOUND
02430	LD	A,(CURCOL)	03120	INC	HL	03830	POP	HL
02440	SLA	A	03130	LD	(HL),55H	03840	LD	B,4
02450	SLA	A	03140	LD	(GUNADR),HL	03850 L26	PUSH	BC
02460	SLA	A	03150	RET		03860	LD	D,H
02470	ADD	A,L	03160 FIRE	LD	A,(3840H)	03870	LD	E,L
02480	LD	L,A	03170	BIT	7,A	03880	CALL	DEC40H
02490	LD	A,8	03180	RET	Z	03890	LD	A,(HL)
02500	SUB	B	03190	CALL	SHTCNT	03900	LD	(DE),A
02510	LD	B,A	03200	LD	HL,(GUNADR)	03910	POP	BC
02520 L20	CALL	INC40H	03210	CALL	DEC40H	03920	DJNZ	L26
02530	DJNZ	L20	03220	LD	B,09H	03930	LD	(HL),20H
02540	LD	(HL),20H	03230 L22	PUSH	BC	03940	LD	A,(TMPCOL)
02550	CALL	INC40H	03240	LD	(HL),22H	03950	LD	B,A
02560	LD	(HL),2AH	03250	LD	B,2	03960	LD	HL,CURLFT-1
02570	EX	DE,HL	03260	CALL	DELAY	03970	LD	DE,BOMBFL-1
02580	DEC	(HL)	03270	LD	(HL),20H	03980 L27	INC	HL
02590	EX	DE,HL	03280	CALL	DEC40H	03990	INC	DE
02600	RET	NZ	03290	POP	BC	04000	DJNZ	L27
02610	LD	(HL),20H	03300	DJNZ	L22	04010	INC	(HL)
02620	CALL	INC40H	03310	LD	A,(GUNPOS)	04020	CALL	INC05H
02630	LD	(HL),20H	03320	LD	HL,TMPCOL	04030	INC	(HL)
02640	PUSH	HL	03330	LD	(HL),1	04040	LD	A,(DE)
02650	LD	HL,0280H	03340	LD	HL,3D40H	04050	AND	8
02660	CALL	SOUND	03350	LD	DE,0008H	04060	RET	NZ
02670	POP	HL	03360	LD	B,5	04070	LD	A,8
02680	DEC	HL	03370	LD	C,0	04080	LD	(DE),A
02690	DEC	HL	03380 L23	INC	C	04090	JP	L16
02700	LD	DE,(GUNADR)	03390	INC	C	04100	RET	
02710	LD	A,E	03400	INC	C	04110 CINTER	LD	HL,3C3EH
02720	CP	L	03410	INC	C	04120	LD	A,(HL)
02730	JP	Z,L45	03420	ADD	HL,DE	04140	CP	48
02740	INC	L	03430	CP	C	04150	JR	Z,L28
02750	INC	L	03440	JP	Z,L25	04160	DEC	(HL)
02760	CP	L	03450	PUSH	HL	04170	RET	
02770	JP	Z,L45	03460	LD	HL,TMPCOL	04180 L28	LD	(HL),39H
02780	INC	L	03470	INC	(HL)	04190	DEC	HL
02790	INC	L	03480	POP	HL	04200	DEC	HL
02800	CP	L	03490	DJNZ	L23	04210	LD	A,(HL)
02810	JP	Z,L45	03510	CP	2	04220	CP	48
02820	LD	HL,BOMBFL	03520	JP	Z,L24	04230	JR	Z,L29
02830	CALL	COLADD	03540	CP	26	04240	DEC	(HL)

04250	RET		04950	JP	Z,L45	05750	INC	DE
04260 L29	LD	(HL),39H	04960	RET		05760	DJNZ	L42
04270	DEC	HL	04970 SOUND	LD	E,0	05770 L44	LD	HL,SHOTS
04280	DEC	HL	04980	LD	D,H	05780	LD	DE,BEST
04290	LD	A,(HL)	04990	SET	7,D	05790	LD	BC,0004H
04300	CP	48	05000	LD	A,9	05800	LDIR	
04310	JP	Z,L1	05010 L36	LD	B,L	05810	RET	
04320	DEC	(HL)	05020 L37	OUT	(0FFH),A	05820 L45	LD	B,64
04330	LD	HL,FIGMOV+1	05030	DEC	DE	05830	LD	A,128
04340	DEC	(HL)	05040	BIT	7,D	05840	PUSH	DE
04350	DEC	(HL)	05050	RET	Z	05850	POP	IX
04360	LD	HL,L31+1	05060	DJNZ	L37	05860	DEC	IX
04370	DEC	(HL)	05070	CPL		05870	DEC	IX
04380	DEC	(HL)	05080	OR	8	05880 L46	LD	(IX+0),A
04390	LD	HL,L33+1	05090	AND	11	05890	LD	(IX+2),A
04400	DEC	(HL)	05100	JR	L36	05900	LD	(IX+4),A
04410	DEC	(HL)	05130 INC40H	PUSH	DE	05910	PUSH	BC
04420	RET		05140	LD	DE,0040H	05920	PUSH	AF
04430 RNDUFO	LD	HL,UFOCNT	05150	SCF		05930	LD	HL,0380H
04440	LD	A,(HL)	05160	CCF		05940	CALL	SOUND
04450	OR	A	05170	ADC	HL,DE	05950	POP	AF
04460	JR	Z,L30	05180	POP	DE	05960	POP	BC
04470	DEC	(HL)	05190	RET		05970	INC	A
04480	RET		05200 DEC40H	LD	B,40H	05980	DJNZ	L46
04490 L30	LD	(HL),8	05210 L38	DEC	HL	06040	JP	L3
04500	LD	HL,UF2CTR	05220	DJNZ	L38	06060 CURBMB	DEFS	2
04510	LD	A,(HL)	05230	RET		06070 LTOGO	DEFS	1
04520	OR	A	05240 COLADD	LD	DE,CURCOL	06080 LTOGOL	DEFS	1
04530	JP	NZ,L34	05250	LD	A,(DE)	06090 CURCOL	DEFS	1
04540	LD	A,R	05260	ADD	A,L	06100 CURLFT	DEFS	5
04550 L31	CP	74H	05270	LD	L,A	06110 TMLFT	DEFS	5
04570	JP	M,L32	05280	LD	A,(HL)	06120 GUNADR	DEFS	2
04580	LD	(HL),14	05290	RET		06130 GUNPOS	DEFS	1
04590	LD	HL,3C04H	05300 INC05H	INC	HL	06140 UF2CTR	DEFS	1
04600	LD	(UF2ADR),HL	05310	INC	HL	06150 UF1CTR	DEFS	1
04610 L32	LD	HL,UF1CTR	05320	INC	HL	06160 UFOCNT	DEFS	1
04620	LD	A,(HL)	05330	INC	HL	06170 UF2ADR	DEFS	2
04630	OR	A	05340	INC	HL	06180 UF1ADR	DEFS	2
04640	JP	NZ,L35	05350	RET		06190 BOMBFL	DEFS	5
04650	LD	A,R	05450 WORL	LD	BC,000CH	06200 TMPCOL	DEFS	1
04660 L33	CP	10	05460	LD	DE,3D10H	06210 WINMSG	DEFM	'# OF SHOTS U TOOK : '
04680	RET	P	05470	LDIR		06220 SHOTS	DEFS	4
04690	LD	(HL),14	05480	LD	B,20H	06230 CHAMP	DEFM	'BEST SO FAR TODAY : '
04700	LD	HL,3C34H	05490 L39	PUSH	BC	06240 BEST	DEFM	'9999'
04710	LD	(UF1ADR),HL	05500	CALL	DELAY	06250 RESTR	DEFM	'PRESS ENTER'
04720	RET		05510	POP	BC	06260 EASY	DEFM	'1 - EASY'
04730 L34	LD	HL,(UF2ADR)	05520	DJNZ	L39	06262 MED	DEFM	'2 - MEDIUM'
04740	LD	(HL),20H	05530	RET		06264 HARD	DEFM	'3 - HARD'
04750	CALL	INC40H	05540 SHTCNT	LD	HL,SHOTS+3	06270 MSG2	DEFM	'U LOSE HUMAN'
04760	LD	(HL),25H	05550 L40	LD	A,(HL)	06280 MSG3	DEFM	'U WIN HUMAN'
04770	LD	(UF2ADR),HL	05570	CP	39H	06290	END	BEGIN
04780	LD	HL,UF2CTR	05580	JR	Z,L41			
04790	DEC	(HL)	05590	INC	(HL)			
04800	LD	A,(HL)	05600	RET				
04810	LD	DE,(UF2ADR)	05610 L41	LD	(HL),30H			
04820	OR	A	05620	DEC	HL			
04830	JP	Z,L45	05630	JR	L40			
04840	JR	L32	05640 NEWWIN	LD	B,4			
04850 L35	LD	HL,(UF1ADR)	05650	LD	HL,SHOTS			
04860	LD	(HL),20H	05660	LD	DE,BEST			
04870	CALL	INC40H	05670 L42	LD	A,(HL)			
04880	LD	(HL),25H	05680	LD	C,A			
04890	LD	(UF1ADR),HL	05690	LD	A,(DE)			
04900	LD	HL,UF1CTR	05700	CP	C			
04910	DEC	(HL)	05710	JR	Z,L43			
04920	LD	A,(HL)	05720	JP	P,L44			
04930	LD	DE,(UF1ADR)	05730	RET	M			
04940	OR	A	05740 L43	INC	HL			

SELF-MODIFYING CODE

FIGMOV+1: Speed variable—
This byte controls the speed of the game.

L31+1: Controls when UFO #1
will appear on the screen.

L33+1: Controls when UFO #2
will appear on the screen.

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GOOD PROGRAMS DO IT ON A DISK

Ken Hipple

So you've finally done it. You went out and got yourself a disk drive or two. Just think, no more forced coffee breaks while waiting for Galaxy Invasion or an Adventure to load. Let's see, all you need to do is use the TAPE command to load the program from tape onto a disk and you're ready to go. For the last time you wait for the program to load from tape. There, it's done. Now all you need to do is type the name, press ENTER, and in no time you are running around trying to shoot a bunch of robots. What do you mean you're not shooting any robots? What do you mean the system reboots every time you try to discover the secret of the Fun House? You mean you didn't know that most tape-based machine language programs won't run from a disk? Well, most won't, but there is an easy way to correct this problem.

THE PROBLEM

The problem is that most of these programs load into memory at a point where they write over part of the disk operating system. When this occurs something is going to happen and it usually isn't going to be what you want. You can relocate the program so that it loads above the DOS but it probably still won't run since most machine language programs will only work if they are loaded into the right locations. What you could do after relocating the program is to change all jumps, calls, and other such commands to reflect the program's new position in memory but, trust me, you don't want to try this. So what is left to do? I'll give you a hint. Once the program you want to run from disk is loaded into memory you don't need the DOS anymore. Now that you know what to do to get Pyramid 2000 onto disk, let me talk about how to get cat hair out of your keyboard. What? You still don't understand about the disk? Well, maybe I'll talk about cat hair next time.

THE SOLUTION

The process for getting a tape-based program to run from disk is easy (it may not sound like it but it is). As a guess, I would say that 99 to 100 percent of all machine language programs that you can get loaded onto disk can be made to run from disk using the following method. The first thing to do is to find the loading address and entry point. Next, the program is relocated to a position above the DOS. Now a short section of code is added to the program and the new program is dumped back to disk with the new entry point being the section of code you added. That's all there is to it. The secret to the whole affair is that short section of added code. What this code does is move the whole program from its new position back to its old position and then transfer control to the old entry point. That gives you an idea of what you need to do and why, so let's get down to the details. While I'll be talking about TRSDOS in particular, the method itself should work with any DOS. The items that might be different would be the names of the commands, utilities used, and the way that the loading address and entry point of a file are stored.

STEP-BY-STEP

The very first thing to do is to get the program from tape onto disk. To do this use the TAPE command. Get the program tape ready to play and enter the following command (<ENTER> means press the white ENTER key): TAPE (S=T,D=D) <ENTER>. You will be prompted for the cassette speed. Press "H" for a high speed cassette or "L" for a low speed cassette. Now press PLAY on your tape deck and then any key on the keyboard. TRSDOS will now load the programs from tape and then write it to disk. Note that some programs will not load onto disk this way (Space Warp and Cosmic Patrol are the only two I know of that will not load).

Once the program is on disk, you are ready to find the loading address and entry point. If you have a utility that will do this for you then use it, otherwise you can use DEBUG to do it. To use DEBUG, first make a note of the name the program was saved under and then get into DEBUG by typing the following command:

DEBUG <ENTER>.

Once in DEBUG, press the "F" key and you will then be asked for a filespec. Type in the name of the program and press <ENTER>. The first record of the file will be displayed on the screen. Look at the two lines at the top of the screen. They should be in one of two formats. In the first format (example 1), (*Editor's note: all the examples are printed at the end of the article, pages 54 and 55.*) the loading address will be the second two bytes (ignore the information to the left of the colon). These are the two bytes underlined in example 1. As with all addresses, the loading address is in the least significant byte (LSB), most significant byte (MSB) order. In other words, if the second two bytes are 0043 then the actual address is 4300H. In the second format, the loading address is in the third pair of bytes on the second line. These are the two bytes underlined in example 2. Now that you have the loading address, write it down somewhere with the note that it is the original loading address. Next you need to find the entry point. To do this, hold down the semicolon key (;). DEBUG will start putting records from the file onto the screen. When it stops, you have reached the last record. This record should contain the entry point. To find it, start at the top of the screen and begin looking for the byte sequence 0202. The two bytes immediately following the two 02 bytes are the entry point. These are the two bytes underlined in example 3. Again, they are in LSB-MSB order. Write this address down with the note that this is the original entry point. I have run across one case where the 0202 bytes sequence was in the next to last record. If you don't find it in the last record, press the hyphen key and page backward one record at a time until you do find the two 02 bytes. After you have found the entry point look at the bytes just before the 0202 bytes. If they are 00, then count how many zero bytes (00 is one zero byte) there are between the 0202 bytes and the first non-zero byte preceding the 0202 bytes. Make a note of this number as the number of zero bytes. Now exit DEBUG by pressing the BREAK key

twice.

You are now going to relocate the program. The only decision to make here is where to relocate it to. You do not want to get in the way of any of the DOS, so any address above 6000 hex should work as long as there is enough memory left to load the program into. I have a 48K machine and usually use A000 hex. To relocate the program type in the following command:

```
RELO PROGRAM/CMD (ADD=0A000) <ENTER>.
```

Substitute the address you want to use for the 0A000 address. If the address you use starts with a letter, be sure to precede it with a zero, otherwise the zero is not needed. In place of PROGRAM/CMD, use the name of your program. Write down the address the program was relocated to with the note that this is the new loading address. Now, to make it easier to find the end of the program in a later step, enter the command:

```
CLEAR <ENTER>.
```

When this is done load the program using the LOAD command:

```
(LOAD PROGRAM/CMD <ENTER>).
```

When the program is loaded go back into DEBUG. A note on DEBUG—when displaying memory the two bytes on the far left side of the screen are the starting address for the line of memory that follows them. Press "D" and you will be asked for the address to be displayed. Enter the new loading address that you made a note of above. Now press "S" to get a full page display. Use the semicolon key to page through memory until you find the end of the program. When you start seeing nothing but zeros, you have found the end. Now use the hyphen (-) key to get back to the first non-zero bytes of memory. This is the end of the program, unless you earlier counted some zero bytes. If you did, then start at the last non-zero byte showing and count off the number of zero bytes you have marked down and this is the end of the program. The first byte after the end of the program is where you are going to add our section of code. Write down this address as the new entry point. To add the new code, press "M". You will be asked for the address to be modified. Enter the address of the new entry point and then press the spacebar (anything other than a space after the address terminates the modify mode). A cursor will appear on the byte you specified. Type in the following with the appropriate addresses entered:

```
21nnnn11000001ssssEDB0C3eeee <ENTER>.
```

The new loading address is nnnn. The original loading address is 0000. The size of the program is ssss. Remember to enter all of these values in LSB-MSB order. The size of the program can be found by subtracting the first memory location of the program from the last one and adding 1. If hexadecimal subtraction isn't for you, then use 4000H for a 16K program or 8000H for a 32K program. Make a note of the last memory location used by the code you added and call it the end location. With this done, exit DEBUG by pressing "Q". You are now ready to dump the program back to disk. Enter the following command:

```
DUMP PROGRAM/CMD
```

```
(START=nnnn,END=eeee,TRA=tttt) <ENTER>.
```

For the program name you might want to use a new name so that if you made a mistake you won't have to read the original program from tape again. The new loading address is nnnn. The end location is eeee (noted

above). The new entry point, here called the transfer address, is tttt. Here you enter the addresses in their correct order. If an address starts with a letter be sure to put a 0 before it. That was it. You are now ready to run your program from disk.

AN EXAMPLE

To show you an actual example of what is done, I'll set up Adventure 8 to run from disk. After the TAPE command is used to load the program onto disk, I get into DEBUG, press "F", and answer the filespec question with ADVENT/CMD. DEBUG will load the first record of the file and display it on the screen. Example 1 is a screen dump of this. Since the file name and date are not on the first line, that means that I have the format where the second two bytes contain the loading address. These bytes are 0043 and are underlined in the example.

I write this down as:

original loading address = 4300H.

Next, I hold down the semicolon key until DEBUG stops putting new records onto the screen. This is the last record of the file. Starting at the top and looking for the 0202 byte sequence, I find it at the location marked 3EF4. The entry point byte sequence follows it and is 5043. I note this as:

original entry point = 4350H.

Example 3 is a screen dump of this, with the entry point underlined. This is one of those programs that have zero bytes on the end of it so I count these and find that there are 35 of them. I write this down as: number of zero bytes = 35. Pressing BREAK twice, I exit DEBUG back to TRSDOS READY. I relocate the program to A000H with the command RELO ADVENT/CMD (ADD=0A000). I note A000 as the new loading address. When this is done I enter the command CLEAR followed by LOAD ADVENT/CMD. With this finished I get back into DEBUG. First I press "S" and then "D" and I answer the prompt with A000. Paging through memory I find that the last non-zero byte is at memory location DCDC. I count down the number of zero bytes I noted earlier and find that the program ends at memory location DCFFH.

Example 4 is a screen dump of this page of memory. To find the size of the program, I subtract the new loading address (A000H) from the ending address (DCFFH) and add 1. This gives me 3D00H and I write this down as the length of the file. The first byte after the end of the program is DD00H (which is on the next page of memory). I write down this address as the new entry point. This is where I want to add my code, so I press "M" and answer the prompt with DD00 followed by a space. The cursor appears and I type in the following line:

```
2100A011004301003DEDB0C35043 <ENTER>.
```

Example 5 is a screen dump of how the screen looks after this is done. When entering the above line, remember that the addresses and the file length are in LSB-MSB order. Looking to find the new ending address I see that it is DD0DH, and I write this down. To find this address I looked at the start of the line and saw that DEBUG had it labeled DD00, which is the location of the first byte of memory on that line. Next I counted over to the last non-zero byte which is byte 13 or in hex, byte D. This is by calling the first byte number 0. If

hexadecimal is not for you, then just use the value for the start of the next line, in this case DD10H. Pressing "Q", I again exit DEBUG and then issue the following command:

DUMP ADVENT/CMD
(START=0A000, END=0DD0D, TRA=0DD00).

For the starting address I used the new loading address. The end address is the new ending location and the transfer address is the new entry point. When the dump is done, Adventure 8 will work from disk.

SUMMARY

This method for getting a tape-based program to run from disk is quick and easy to do. Not counting the time spent loading the program from tape, it takes me about 5 minutes. Its limitations are slight. The main one is that

the program must be capable of being loaded onto disk. Since most programs will load onto disk even if they won't run from it, this is not a serious problem. Of course, the program won't have any of the additional capabilities that the regular disk version may have. Other than these two items, this method works very well. I have seen programs that will do most of the work involved for you, but considering the small amount of time and effort needed to do it by hand, I don't feel that they are worth buying. I hope you find this method as easy to use and useful as I have. Have fun doing it on a disk.

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```
000100: 0102 0043 C371 4FC3 0E51 C396 4EC3 904B ...C.qD..Q..N..K
000110: C353 4CC3 7E4C C3F8 4CC3 614E C3EA 4EC3 .SL..L..L.aN..N.
000120: 244F C329 57C3 0E57 C3EE 55C3 2A54 C3E0 $D.)W..W..U.*T..
000130: 53C3 6943 C327 47C3 2547 C316 47C3 9447 S.iC.'G.%G..G..G
000140: C3F3 47C3 FE46 C302 47C3 544A C35E 4ADD ..G..F..G.TJ..J.
000150: 6601 19DD F33E 4306 01FE 7028 0531 D759 f....>C...p(.1.Y
000160: 0600 78CD F347 32D2 57B7 C44B 43CD 0C48 ..x...G2.W..KC..H
000170: 225B 43CD BC4A CD8F 43CD F347 CD12 4318 ".C..J..C..G..C.
000180: 09CD E448 CD00 43CD 7C48 9732 5C59 CD00 ...H..C..H.2.Y..
000190: 4318 EECF F347 21CD 43CD 1647 2AF7 58CD C....G!.C..G*.X.
0001A0: 5E4A 21FD 43CD 1647 2AF3 58CD 5E4A DD2A .J!.C..G*.X..J.*
0001B0: 5359 01FD FFDD 09DD 7E01 DD77 02DD 7E00 SY.....w....
0001C0: DD77 01DD 3600 2E21 0844 CD16 47CD 9447 .w..6...!.D..G..G
0001D0: C92A 2041 4456 454E 5455 5245 202A 2028 .* ADVENTURE * (
0001E0: 5665 7273 696F 6E3A 2038 2E32 2920 4164 Version: 8.2) Ad
0001F0: 7665 6E74 7572 6520 6E75 6D62 6572 3A20 venture number:
```

Example 1

```
000100: 0510 4144 564E 3820 2020 3038 2F30 342F ..ADVNB 08/04/
000110: 3832 0100 00A0 C371 4FC3 0E51 C396 4EC3 82.....qD..Q..N.
000120: 904B C353 4CC3 7E4C C3F8 4CC3 614E C3EA .K.SL..L..L.aN..
000130: 4EC3 244F C329 57C3 0E57 C3EE 55C3 2A54 N.$D.)W..W..U.*T
000140: C3E0 53C3 6943 C327 47C3 2547 C316 47C3 ..S.iC.'G.%G..G.
000150: 9447 C3F3 47C3 FE46 C302 47C3 544A C35E .G..G..F..G.TJ..
000160: 4ADD 6601 19DD F33E 4306 01FE 7028 0531 J.f....>C...p(.1
000170: D759 0600 78CD F347 32D2 57B7 C44B 43CD .Y..x...G2.W..KC.
000180: 0C48 225B 43CD BC4A CD8F 43CD F347 CD12 .H".C..J..C..G..
000190: 4318 09CD E448 CD00 43CD 7C48 9732 5C59 C....H..C..H.2.Y
0001A0: CD00 4318 EECF F347 21CD 43CD 1447 2AF7 ..C....G!.C..G*.
0001B0: 58CD 5E4A 21FD 43CD 1647 2AF3 58CD 5E4A X..J!.C..G*.X..J
0001C0: DD2A 5359 01FD FFDD 09DD 7E01 DD77 02DD .*SY.....w..
0001D0: 7E00 DD77 01DD 3600 2E21 0844 CD16 47CD ...w..6...!.D..G.
0001E0: 9447 C92A 2041 4456 454E 5455 5245 202A .G.* ADVENTURE *
0001F0: 2028 5665 7273 696F 6E3A 2038 2E32 2920 (Version: 8.2)
```

Example 2

```

003E00: 0000 0000 0000 0000 0000 000B 0000 0000 .....
003E10: 0014 0015 0000 0000 0009 0000 0000 00FA .....
003E20: 5DFB 5D0C 5E19 5E1B 5E24 5E32 5E43 5E6D .....$.2.C.m
003E30: 5EA4 5EE1 5EF9 5E10 5F32 5F54 5F6D 5F82 .....2.T.m..
003E40: 5F98 5FA0 5FA9 5FC4 5FE7 5F07 602D 6061 .....@-@a
003E50: 608B 609E 60A9 60B1 60BD 60C7 60D0 60E7 @.@.@.@.@.@.@.
003E60: 6003 6109 6116 6132 6146 61A0 61B5 61B7 @.a.a.a2aFa.a.a.
003E70: 61B9 61D1 61E2 61FB 610C 6211 6230 623C a.a.a.a.a.b.b0b<
003E80: 626B 6288 629A 62AF 62D2 62F2 6206 6312 bkb.b.b.b.b.b.c.
003E90: 6338 6359 6364 6370 637C 637E 6384 63A2 c8cYcdcp.c.c.c.c.
003EA0: 63AB 63B5 63C5 63D8 63E4 630B 6427 644F c.c.c.c.c.c.d'd0
003EB0: 6466 6495 64BB 64CA 64E8 64FF 6418 6537 dfd.d.d.d.d.d.e7
003EC0: 6552 6555 656C 6582 65B9 65F6 6509 6634 eReUe1e.e.e.e.f4
003ED0: 6600 0000 0000 0000 0000 0000 0000 0000 f.....
003EE0: 0000 0000 0000 0000 0000 0000 0000 0000 .....
003EF0: 0000 0000 0202 5043 2054 616E 6479 2020 .....PC Tandy

```

Example 3

```

DC00 0008 0000 0000 0000 0000 0000 0000 .....
DC10 0000 0000 0000 000B 0000 0000 0014 0015 .....
DC20 0000 0000 0009 0000 0000 00FA 5DFB 5D0C .....
DC30 5E19 5E1B 5E24 5E32 5E43 5E6D 5EA4 5EE1 .....$.2.C.m....
DC40 5EF9 5E10 5F32 5F54 5F6D 5F82 5F98 5FA0 .....2.T.m.....
DC50 5FA9 5FC4 5FE7 5F07 602D 6061 608B 609E .....@-@a@.@.
DC60 60A9 60B1 60BD 60C7 60D0 60E7 6003 6109 @.@.@.@.@.@.a.
DC70 6116 6132 6146 61A0 61B5 61B7 61B9 61D1 a.a2aFa.a.a.a.a.
DC80 61E2 61FB 610C 6211 6230 623C 626B 6288 a.a.a.b.b0b<bkb.
DC90 629A 62AF 62D2 62F2 6206 6312 6338 6359 b.b.b.b.b.b.c.c8cY
DCA0 6364 6370 637C 637E 6384 63A2 63AB 63B5 cdcp.c.c.c.c.c.c.
DCB0 63C5 63D8 63E4 630B 6427 644F 6466 6495 c.c.c.c.c.d'd0dfd
DCC0 64BB 64CA 64E8 64FF 6418 6537 6552 6555 d.d.d.d.d.d.e7eReU
DCD0 656C 6582 65B9 65F6 6509 6634 6600 0000 ele.e.e.e.e.f4f...
DCE0 0000 0000 0000 0000 0000 0000 0000 0000 .....
DCF0 0000 0000 0000 0000 0000 0000 0000 0000 .....

```

Example 4

```

DD00 2100 A011 0043 0100 3DED B0C3 5043 0000 !....C..=...PC...
DD10 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD20 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD30 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD40 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD50 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD60 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD70 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD80 0000 0000 0000 0000 0000 0000 0000 0000 .....
DD90 0000 0000 0000 0000 0000 0000 0000 0000 .....
DDA0 0000 0000 0000 0000 0000 0000 0000 0000 .....
DDB0 0000 0000 0000 0000 0000 0000 0000 0000 .....
DDC0 0000 0000 0000 0000 0000 0000 0000 0000 .....
DDD0 0000 0000 0000 0000 0000 0000 0000 0000 .....
DDE0 0000 0000 0000 0000 0000 0000 0000 0000 .....
DDF0 0000 0000 0000 0000 0000 0000 0000 0000 .....

```

Example 5

RUBIK'S CUBE and INTERVAL

William H. Patrick

RUBIK'S CUBE

Want to get your cube back into the proper form? This program will show and tell you how. You may start with a standard cube or enter the colors from your own. You can try to work the cube or back up steps, having the reverse moves printed on the screen to get you back to where you started. Or you can have the computer tell you, in simple English, how to work it. No, it won't beat the kid down the block, but it does work. So take your cube, go into your TRS-80 room, lock the door, and END THE FRUSTRATION. Who's to know that you haven't finally figured out the blasted thing?

This program is based on *The Simple Solution to Rubik's Cube* by James G. Nourse, Stanford University, and the program draws upon the article "Rubik's Cube" by Gordon Speer in the October 1981 issue of *Computronics*.

```
0 CLS: PRINT CHR$(23): PRINT@ 206, "RUBIK'S CUBE";
1 PRINT@ 328, "WILLIAM H. PATRICK";
2 PRINT@ 390, "RT7 PARADISE CAMP RD ";
3 PRINT@ 454, "HARRODSBURG, KENTUCKY"
4 PRINT@ 516, "    40330";
5 PRINT@ 644, "BASED ON SOLUTION BY-"
6 PRINT@ 716, "JAMES G. NOURSE ";. PRINT @ 776, "STANFORD
UNIVERSITY",
7 REM    JANUARY 1982
8 REM    "RUBIK'S CUBE" AN ARTICLE BY GORDON SPEER
        (3304 WOODLAWN DR., STERLING, IL 61081)
        PUBLISHED IN OCTOBER 1981 *COMPUTRONICS*
        WAS USED IN DEVELOPING THIS PROGRAM.
9 FOR II=1 TO 4000:NEXT
10 CLS' RUBIK'S CUBE
20 CLEAR 2000
30 DEFSTR A,C,T
31 DIM C(3,3,3)
32 MC=1
33 DIM MV$(200) 'MAX MOVES
40 GOSUB 1000 ' INTRODUCTION
50 GOSUB 2000 ' SET UP CUBE
54 CLS
55 GOSUB 10000
60 GOSUB 3000 'INPUT MOVES
65 GOTO 55
80 END
1000 REM ***** INSTRUCTIONS *****
1010 PRINT "THE FOLLOWING KEYS ARE TO BE USED -"
1015 PRINT: PRINT TAB(1),"KEY","FUNCTION (NOTICE NUMERIC PAD)"
1020 PRINT TAB(1),"8","TOP OF CUBE"
1030 PRINT TAB(1),"4","LEFT OF CUBE"
1040 PRINT TAB(1),"5","FRONT OF CUBE"
1050 PRINT TAB(1),"6","RIGHT OF CUBE"
1060 PRINT TAB(1),"2","BOTTOM OF CUBE"
1065 PRINT TAB(1),"T","TRANSVERSE ROTATION": PRINT
TAB(1),"L","LONGITUDINAL ROTATION": PRINT TAB(1),"H",
"HORIZONTAL ROTATION";
1070 PRINT
1080 PRINT TAB(1),"0","CLOCKWISE"
1090 PRINT TAB(1),".", "COUNTER- CLOCKWISE"
1100 PRINT "ENTER A FACE FOLLOWED BY A DIRECTION."
1110 PRINT:INPUT "<ENTER> TO CONTINUE";PG$
1120 CLS. PRINT "TWO ADDITIONAL FEATURES."
```

```
1130 PRINT: PRINT TAB(1), "M#","HAVE YOUR LAST # MOVES
REVERSED."
1140 PRINT TAB(1),"??","HAVE THE CUBE WORKED FOR YOU."
1142 PRINT
1145 PRINT TAB(1),"##","HAVE CUBE RANDOMLY MOVED"
1150 PRINT@960,;:INPUT"<ENTER> TO BEGIN";PG$: RETURN
1160 REM    *** END OF INSTRUCTIONS ***
2000 REM ***** SET UP CUBE *****
2010 INPUT" SET UP STANDARD CUBE OR INPUT YOURS (S/Y)";D$
2020 IF D$="S" THEN 2500
2030 IF D$="Y" THEN 2100
2040 PRINT"ENTER 'S' FOR STANDARD CUBE, 'Y' TO ENTER YOURS."
2050 GOTO 2010
2100 CLS:REM SET UP YOUR CUBE
2110 PRINT "THINK OF YOUR CUBE AS BEING MADE UP OF 27 SMALL
CUBES": PRINT : PRINT "THE IDENTIFICATION OF EACH CUBE IS 3
CHARACTERS-"
2120 PRINT TAB(1),"FIRST","TOP OR BOTTOM COLOR": PRINT
TAB(1), "SECOND","LEFT OR RIGHT COLOR": PRINT TAB(1),
"THIRD","FRONT OR BACK COLOR"
2125 INPUT "<ENTER> TO CONTINUE";PG$:CLS: PRINT "ENTER CUBES
-": PRINT: PRINT TAB(1),"TOP LAYER FIRST": PRINT TAB(1),"FRONT
ROW FIRST": PRINT TAB(1),"LEFT CUBE FIRST"
2130 PRINT@ 512+128,"IF A COLOR IS NOT VISIBLE, SIMPLY PRESS
<ENTER>";
2140 FOR V=1 TO 3:FOR D=1 TO 3:FOR H=1 TO 3
2143 PRINT@ 320,"CUBE";(V-1)*9+(D-1)*3+H;
2150 PRINT@ 384,;:INPUT"TOP OR BOTTOM COLOR";A$:IF A$="" THEN
A$="-"
2160 PRINT@ 448,;:INPUT "LEFT OR RIGHT COLOR";B$:IF B$=""
THEN B$="-"
2170 PRINT@ 512, ;:INPUT "FRONT OR BACK COLOR";C$:IF C$=""
THEN C$="-"
2180 C(V,H,D)=A$+B$+C$
2181 A$="":B$="":C$=""
2185 PRINT@ 384,STRING$(192,32);
2190 IF LEN(C(V,H,D))>3 THEN PRINT"ENTER THAT CUBE AGAIN.";:
GOTO 2150
2200 NEXT H,D,V
2210 GOTO 2999
2500 REM SET UP STANDARD CUBE
2510 FOR V=1 TO 3:FOR H=1 TO 3:FOR D=1 TO 3: READ C(V,H,D):
NEXT D,H,V
2520 DATA RGW,RG-,RGY,R-W,R--,R-Y,ROW,RO-,ROY,-GW,-G-, -GY,
--W,--,--Y,- OW,-O-, -OY,BGW,BG-,BGY,B-W,B--,B-Y,BOW,BO-,BOY
2999 RETURN
3000 REM **** INPUT MOVES FROM KEYBOARD ****
3010 N$=INKEY$:IF N$="" THEN 3010 ELSE PRINT@ 822,N$," ";
3020 M$=INKEY$:IF M$="" THEN 3020 ELSE PRINT@ 826,M$;
3021 IF( N$="8" OR N$="4" OR N$="5" OR N$="6" OR N$="2" OR
N$="T" OR N$="L" OR N$="H") AND (M$="0" OR M$=".") THEN
MV$(MC)=N$+M$:MC=MC+1
3025 PRINT@ 822, " ";
3030 GOSUB 3049 -
3047 RETURN
3048 REM    **** END OF INPUT ****
3049 REM ***** DETERMINE MOVE TO MAKE *****
3050 PRINT@ 822,N$;M$;: PRINT@ 960,STRING$(30,32);: PRINT @
804, "MOVE";MC-1;:IF N$="8" AND M$="0" THEN GOSUB 14010:
GOTO 3999
3051 IF N$="2" AND M$="0" THEN GOSUB 14020: GOTO 3999
3052 IF N$="4" AND M$="." THEN GOSUB 14030: GOTO 3999
3053 IF N$="4" AND M$="0" THEN GOSUB 14040: GOTO 3999
3054 IF N$="6" AND M$="0" THEN GOSUB 14050: GOTO 3999
```

```

3055 IF N$="6" AND M$="." THEN GOSUB 14060: GOTO 3999
3056 IF N$="5" AND M$="0" THEN GOSUB 14070: GOTO 3999
3057 IF N$="5" AND M$="." THEN GOSUB 14080: GOTO 3999
3058 IF N$="8" AND M$="." THEN GOSUB 14090: GOTO 3999
3059 IF N$="2" AND M$="." THEN GOSUB 14100: GOTO 3999
3060 IF N$="L" AND M$="." THEN GOSUB 14110: GOTO 3999
3061 IF N$="L" AND M$="0" THEN GOSUB 14120: GOTO 3999
3062 IF N$="H" AND M$="0" THEN GOSUB 14130: GOTO 3999
3063 IF N$="H" AND M$="." THEN GOSUB 14140: GOTO 3999
3064 IF N$="T" AND M$="0" THEN GOSUB 14150: GOTO 3999
3065 IF N$="T" AND M$="." THEN GOSUB 14160: GOTO 3999
3066 IF N$="#" THEN GOSUB 45000: GOTO 3999 ELSE IF N$="?"
THEN GOSUB 50000
3067 IF N$="H" THEN GOSUB 40000: GOTO 3999
3068 PRINT@ 960,"INPUT ERROR ";N$;M$;:FOR ZX=1 TO 500:
NEXT: GOTO 3010
3500 REM      REPLAY LAST MOVES
3999 RETURN '      **** RETURN FROM DETERMINING MOVE ****
4000 REM      ***** REMAKE MOVES FROM MEMORY *****
4010 Q=VAL(M$):XX=MC-1
4015 PRINT@ 960,"REVERSING MOVES "XX "TO" XX-Q;
4017 FOR ZZ=1 TO 500:NEXT
4020 FOR II= XX TO XX-Q+1 STEP -1
4021 MC=MC-1
4030 N$=LEFT$(MV$(II),1)
4040 P$= RIGHT$(MV$(II),1)
4050 IF P$="0" THEN M$="." ELSE M$="0"
4060 GOSUB 3049
4061 GOSUB 10000
4063 IF INKEY$="" THEN 4063
4065 NEXT II
4066 IF MC<0 THEN MC=0
4070 RETURN
4500 REM      **** MIX UP CUBE ****
4505 RANDOM
4506 FOR XX=1 TO 50
4510 W=RND(5)
4520 ON W GOTO 4530,4540,4550,4560,4570
4530 N$="8": GOTO 4580
4540 N$="4": GOTO 4580
4550 N$="5": GOTO 4580
4560 N$="6": GOTO 4580
4570 N$="2"
4580 W=RND(2)
4590 IF W=1 THEN M$="0" ELSE M$="."
4600 GOSUB 3049
4610 NEXT XX
4615 PRINT@ 960,STRING$(30,32);
4620 RETURN '      *** END OF RANDOM MOVES ***
5000 REM      ***** WORK CUBE *****
5001 PRINT@ 960,"SINGLE STEP Y/N?";:Q$=INKEY$:IF Q$=""
THEN 5001 ELSE IF Q$="Y" THEN ZFLAG=1
5005 PRINT@ 960,"      TOP EDGES      ";:REM ***** TOP
FRONT EDGE *****
5010 P1$=LEFT$(C(1,2,2),1):P2$=RIGHT$(C(2,2,1),1):P3$="."
5015 GOSUB 9900 ' FIND CUBE
5020 IF X=1 AND Y=2 AND Z=1 THEN GOTO 5100 'CUBE IS CORRECTLY
POSITIONED
5025 IF X=3 AND Z<1 THEN N$="2":M$="0": GOSUB 3049: GOSUB
10000: GOTO 5015
5030 IF Z=1 THEN N$="5":M$="0": GOSUB 3049: GOSUB 10000:
GOTO 5015
5035 IF X=2 AND Y=1 THEN N$="4":M$="." : GOSUB 3049: GOSUB
10000: N$="2":M$="0": GOSUB 3049: GOSUB 10000:N$="4":M$="0":
GOSUB 3049: GOSUB 10000: GOTO 5015
5040 IF X=2 AND Y=3 THEN N$="6":M$="0": GOSUB 3049:
GOSUB 10000: N$="2":M$="." : GOSUB 3049: GOSUB 10000: N$="6":
M$="." : GOSUB 3049: GOSUB 10000: GOTO 5015

```

```

5045 IF X=1 AND Y=1 THEN N$="4":M$="0": GOSUB 3049: GOSUB
10000: N$="5":M$="0": GOSUB 3049: GOSUB 10000:N$="4":M$="." :
GOSUB 3049: GOSUB 10000: GOTO 5015
5050 IF X=1 AND Y=3 THEN N$="6":M$="." : GOSUB 3049: GOSUB
10000: N$="5":M$="." : GOSUB 3049: GOSUB 10000:N$="6":M$="0":
GOSUB 3049: GOSUB 10000: GOTO 5015
5055 IF X=1 AND Z=3 THEN N$="H":M$="0": GOSUB 3049: GOSUB
10000:N$="6":M$="." : GOSUB 3049: GOSUB 10000:N$="H":M$="." :
GOSUB 3049: GOSUB 10000: GOTO 5015
5100 A$=LEFT$(C(1,2,2),1)+"-"+RIGHT$(C(2,2,1),1): IF
C(1,2,1)=A$ THEN 5150 ' CUBE IS CORRECTLY ORIENTED
5110 N$="5":M$="." : GOSUB 3049: GOSUB 10000
5120 N$="8":M$="0": GOSUB 3049: GOSUB 10000
5130 N$="4":M$="." : GOSUB 3049: GOSUB 10000
5140 N$="8":M$="." : GOSUB 3049: GOSUB 10000: GOTO 5100
5150 A$=LEFT$(C(1,2,2),1)+MID$(C(2,3,2),2,1)+"-":
B$=LEFT$(C(1,2,2),1)+"-"+RIGHT$(C(2,2,3),1):
C$=LEFT$(C(1,2,2),1)+MID$(C(2,1,2),2,1)+"-": IF C(1,3,2)=A$
AND C(1,2,3)=B$ AND C(1,1,2)=C$ THEN GOTO 5200 ' CORRECT
EDGES
5160 PRINT@ 960,"FINISHED ONE";: N$="H":M$="0": GOSUB 3049:
GOSUB 10000: GOTO 5005
5200 PRINT @ 960,"      TOP CORNERS      ";:REM ***** TOP
CORNERS *****
5205 P1$=LEFT$(C(1,2,2),1): P2$=MID$(C(2,1,2),2,1):
P3$=RIGHT$(C(2,2,1),1)
5210 GOSUB 9900
5215 IF X=1 AND Y=1 AND Z=1 THEN 5300'REM CORRECT POSITION
5220 IF X=1 AND Y=1 AND Z=3 THEN N$="4":M$="." : GOSUB 3049:
GOSUB 10000:N$="2":M$="0": GOSUB 3049: GOSUB 10000: N$="4":
M$="0": GOSUB 3049: GOSUB 10000: GOTO 5205
5225 IF X=1 AND Y=3 AND Z=3 THEN N$="6":M$="0": GOSUB 3049:
GOSUB 10000:N$="2":M$="." : GOSUB 3049: GOSUB 10000: N$="6":
M$="." : GOSUB 3049: GOSUB 10000: GOTO 5205
5230 IF X=1 AND Y=3 AND Z=1 THEN N$="6":M$="." : GOSUB 3049:
GOSUB 10000:N$="2":M$="." : GOSUB 3049: GOSUB 10000: N$="6":
M$="0": GOSUB 3049: GOSUB 10000: GOTO 5205
5240 IF (X=3 AND Y<1) OR (X=3 AND Z<1) THEN N$="2":
M$="0": GOSUB 3049: GOSUB 10000: GOTO 5205
5245 N$="4":M$="0": GOSUB 3049: GOSUB 10000:N$="2":M$="0":
GOSUB 3049: GOSUB 10000:N$="4":M$="." : GOSUB 3049: GOSUB
10000: GOTO 5205
5300 IF LEFT$(C(1,1,1),1)=LEFT$(C(1,2,2),1) AND
MID$(C(1,1,1),2,1)=MID$(C(2,1,2),2,1) AND
RIGHT$(C(1,1,1),1)=RIGHT$(C(2,2,1),1) THEN 5350 ' CORRECT
ORIENTATION
5305 Z$="H.6.2020605020205.H0": FOR I=1 TO 19 STEP 2:
N$=LEFT$(MID$(Z$,I,2),1): M$=RIGHT$(MID$(Z$,I,2),1): GOSUB
3049: GOSUB 10000:NEXT: GOTO 5205
5350 IF LEFT$(C(1,2,2),1)=LEFT$(C(1,3,1),1) AND
LEFT$(C(1,2,2),1)=LEFT$(C(1,3,3),1) AND
LEFT$(C(1,2,2),1)=LEFT$(C(1,1,3),1) AND
MID$(C(2,3,2),2,1)=MID$(C(1,3,1),2,1) AND
MID$(C(2,3,2),2,1)=MID$(C(1,3,3),2,1) AND
MID$(C(2,1,2),2,1) = MID$(C(1,1,3),2,1) THEN 5360
5355 N$="H":M$="0": GOSUB 3049: GOSUB 10000: GOTO 5205
5360 IF RIGHT$(C(2,2,1),1)=RIGHT$(C(1,3,1),1) AND
RIGHT$(C(1,3,3),1)=RIGHT$(C(2,2,3),1) AND
RIGHT$(C(1,1,3),1)=RIGHT$(C(2,2,3),1) THEN 5400 ELSE 5355
5400 PRINT @ 960,"      SECOND LEVEL      ";:REM *****
SECOND LEVEL *****
5405 N$="L":M$="." : GOSUB 3049: GOSUB 10000: N$="L":
M$="." : GOSUB 3049: GOSUB 10000
5410 P1$=RIGHT$(C(2,2,1),1): P2$=MID$(C(2,3,2),2,1):P3$="."
5415 GOSUB 9900
5420 IF RIGHT$(C(2,3,1),1)=RIGHT$(C(2,2,1),1) AND
MID$(C(2,3,1),2,1)=MID$(C(2,3,2),2,1) THEN 5500 ' CUBE IS
CORRECT

```

```

5425 IF X=2 AND Y=3 AND Z=1 THEN GOSUB 5490: N$="8": M$="":
GOSUB 3049: GOSUB 10000: GOSUB 5490: GOTO 5410 ' ORIENT A
CORRECTLY POSITIONED CUBE
5440 IF X=1 AND Y=1 AND Z=2 THEN GOSUB 5490: GOTO 5410
' POSITION FROM TLE
5450 IF X=1 AND Y<1 THEN N$="8": M$="0": GOSUB 3049: GOSUB
10000: GOTO 5410 ' WAS IN TOP BUT NOT TLE
5452 IF X=2 AND Y=3 THEN N$="H": M$="0": GOSUB 3049: GOSUB
10000: GOSUB 5490: N$="H": M$="": GOSUB 3049: GOSUB 10000:
GOTO 5410
5455 IF X=2 THEN N$="H": M$="0": GOSUB 3049: GOSUB 10000:
GOTO 5410
5489 REM *** SUB TO MOVE TLE TO FRE
5490 Z$="6.0806.8.5.8.50": FOR I=1 TO 13 STEP 2:
N$=LEFT$(MID$(Z$,I,2),1): M$=RIGHT$(MID$(Z$,I,2),1):
GOSUB 3049: GOSUB 10000: NEXT: RETURN
5500 IF MID$(C(2,3,3),2,1)=MID$(C(2,3,2),2,1) AND
RIGHT$(C(2,3,3),1)=RIGHT$(C(2,2,3),1) AND
MID$(C(2,1,3),2,1)=MID$(C(2,1,2),2,1) AND
RIGHT$(C(2,1,3),1)=RIGHT$(C(2,2,3),1) AND
MID$(C(2,1,1),2,1)=MID$(C(2,1,2),2,1) THEN 5501 ELSE 5505
5501 IF RIGHT$(C(2,1,1),1)=RIGHT$(C(2,2,1),1) THEN 5600
' 2ND LEVEL IS FINISHED
5505 N$="H": M$="0": GOSUB 3049: GOSUB 10000: GOTO 5410
5600 REM ***** THIRD LEVEL *****
5601 PRINT@ 960,"BOTTOM CORNERS ";; FOR ZZ=1
TO 500: NEXT
5605 N$="L": M$="0": GOSUB 3049: GOSUB 10000: N$="L": M$="0":
GOSUB 3049: GOSUB 10000 ' TURN CUBE OVER
5610 REM POSITION CORNERS
5615 REM POSITION 3,1,3
5620 P1$=MID$(C(2,1,2),2,1): P2$=RIGHT$(C(2,2,3),1):
P3$=LEFT$(C(3,2,2),1)
5625 GOSUB 9900
5630 IF X=3 AND Y=1 AND Z=3 THEN 5640
5635 N$="2": M$="0": GOSUB 3049: GOSUB 10000: GOTO 5620
5640 REM POSITION 3,1,1
5645 P1$=LEFT$(C(3,2,2),1): P2$=MID$(C(2,1,2),2,1):
P3$=RIGHT$(C(2,2,1),1)
5650 GOSUB 9900
5655 IF X=3 AND Y=1 AND Z=1 THEN 5675 ' REM DFL IS CORRECT
5660 IF X=3 AND Y=3 AND Z=1 THEN GOSUB 6001: GOTO 5640
5665 IF X=3 AND Y=3 AND Z=3 THEN GOSUB 6003: GOTO 5640
5670 PRINT "SOMETHING'S HAYWIRE": END
5675 REM POSITION 3,3,1
5680 P1$=LEFT$(C(3,2,2),1): P2$=MID$(C(2,3,2),2,1):
P3$=RIGHT$(C(2,2,1),1)
5685 GOSUB 9900
5690 IF X=3 AND Y=3 AND Z=1 THEN 6100
5695 N$="H": M$="0": GOSUB 3049: GOSUB 10000: GOSUB 6001
5700 GOTO 6100 ' CORNERS ARE POSITIONED
6000 REM SWAP DFL WITH DFR
6001 Z$="6.2.6050205.6.20602020": FOR II=1 TO 21 STEP 2:
N$=LEFT$(MID$(Z$,II,2),1): M$=RIGHT$(MID$(Z$,II,2),1):
GOSUB 3049: GOSUB 10000: NEXT: RETURN
6003 REM SWAP DFL WITH DBR
6004 Z$="6.2.605020205.6.20602020": FOR II=1 TO 21 STEP 2:
N$=LEFT$(MID$(Z$,II,2),1): M$=RIGHT$(MID$(Z$,II,2),1):
GOSUB 3049: GOSUB 10000: NEXT: RETURN
6100 REM ORIENT BOTTOM CORNERS
6105 REM COUNT NUMBER OF BOTTOM CORNERS THAT MATCH
6110 BC=0
6115 B$=LEFT$(C(3,2,2),1) ' REM COLOR TO MATCH
6125 IF LEFT$(C(3,1,1),1)=B$ THEN BC=BC+1
6135 IF LEFT$(C(3,3,1),1)=B$ THEN BC=BC+1
6140 IF LEFT$(C(3,3,3),1)=B$ THEN BC=BC+1
6145 IF LEFT$(C(3,1,3),1)=B$ THEN BC=BC+1
6150 IF BC=4 THEN 7000 ' REM BOTTOM CORNERS ARE CORRECT
6155 IF BC=2 THEN 6160 ELSE 6300

```

```

6160 IF LEFT$(C(3,1,3),1)=B$ AND LEFT$(C(3,3,1),1)=B$ AND
RIGHT$(C(3,1,1),1)=B$ AND MID$(C(3,3,3),2,1)=B$ THEN
GOSUB 6900: GOTO 6105 ' PATTERN 6
6165 IF LEFT$(C(3,1,3),1)=B$ AND LEFT$(C(3,3,3),1)=B$ AND
RIGHT$(C(3,1,1),1)=B$ AND RIGHT$(C(3,3,1),1)=B$ THEN GOSUB
6900: GOTO 6105 ' PATTERN 5
6170 IF LEFT$(C(3,3,1),1)=B$ AND LEFT$(C(3,3,3),1)=B$ AND
RIGHT$(C(3,1,1),1)=B$ AND RIGHT$(C(3,1,3),1)=B$ THEN GOSUB
6900: GOTO 6105 ' PATTERN 4
6175 N$="H": M$="0": GOSUB 3049: GOSUB 10000:
6299 GOTO 6105
6300 IF BC=1 THEN 6305 ELSE 6600
6305 IF LEFT$(C(3,1,1),1)=B$ AND RIGHT$(C(3,3,1),1)=B$ AND
RIGHT$(C(3,1,3),1)=B$ AND MID$(C(3,3,3),2,1)=B$ THEN
GOSUB 6900: GOTO 6105 ' PATTERN 1
6310 IF LEFT$(C(3,1,1),1)=B$ AND RIGHT$(C(3,3,3),1)=B$ AND
MID$(C(3,1,3),2,1)=B$ AND MID$(C(3,3,1),2,1)=B$ THEN GOSUB
6900: GOTO 6105 ' PATTERN 2
6315 N$="H": M$="0": GOSUB 3049: GOSUB 10000
6599 GOTO 6105
6600 REM BC=0
6605 IF RIGHT$(C(3,1,3),1)=B$ AND RIGHT$(C(3,3,3),1)=B$ AND
MID$(C(3,1,1),2,1)=B$ AND MID$(C(3,3,1),2,1)=B$ THEN GOSUB
6900: GOTO 6105 ' REM PATTERN 3
6610 IF MID$(C(3,1,1),2,1)=B$ AND MID$(C(3,3,1),2,1)=B$ AND
MID$(C(3,3,3),2,1)=B$ AND MID$(C(3,1,3),2,1)=B$ THEN GOSUB
6900: GOTO 6105 ' PATTERN 7
6700 N$="H": M$="0": GOSUB 3049: GOSUB 10000
6899 GOTO 6105
6900 Z$="6.2.602.6.2020602020": FOR ZZ=1 TO 19 STEP 2:
N$=LEFT$(MID$(Z$,ZZ,2),1): M$=RIGHT$(MID$(Z$,ZZ,2),1):
GOSUB 3049: GOSUB 10000: NEXT: RETURN
7000 PRINT@ 960,"BOTTOM EDGES ";; FOR ZZ=1 TO
500: NEXT
7002 B$=LEFT$(C(3,2,2),1) ' BOTTOM COLOR
7005 ZT=0
7010 IF RIGHT$(C(3,2,1),1)=RIGHT$(C(2,2,1),1) OR
RIGHT$(C(2,2,1),1)=LEFT$(C(3,2,1),1) THEN 7100 ' FRONT EDGE
CORRECTLY POSITIONED
7015 N$="H": M$="0": GOSUB 3049: GOSUB 10000: ZT=ZT+1
7020 IF ZT<5 THEN 7010 ELSE GOSUB 7900: GOTO 7005
7100 REM CHECK ALL POSITIONS
7110 IF (MID$(C(2,1,2),2,1)=MID$(C(3,1,2),2,1) OR
MID$(C(2,1,2),2,1)=LEFT$(C(3,1,2),1)) AND
(MID$(C(3,3,2),2,1)=MID$(C(2,3,2),2,1) OR
MID$(C(2,3,2),2,1)=LEFT$(C(3,3,2),1)) AND
(RIGHT$(C(2,2,3),1)=RIGHT$(C(3,2,3),1) OR
LEFT$(C(3,2,3),1)=RIGHT$(C(2,2,3),1)) THEN 8000
7111 GOSUB 7900: GOTO 7100
7900 Z$="4.6050406.20204.6050406": FOR II=1 TO 23 STEP 2:
N$=LEFT$(MID$(Z$,II,2),1): M$=RIGHT$(MID$(Z$,II,2),1): GOSUB
3049: GOSUB 10000: NEXT II: RETURN
8000 PRINT@ 960," FINAL STEP ";; FOR II=1 TO
500: NEXT
8005 REM MATCH BOTTOM PATTERNS
8010 IF RIGHT$(C(3,2,1),1)=B$ AND RIGHT$(C(3,2,3),1)=B$ AND
MID$(C(3,3,2),2,1)=B$ AND MID$(C(3,1,2),2,1)=B$ THEN 8100
' REM PATTERN 1
8015 IF LEFT$(C(3,1,2),1)=B$ AND LEFT$(C(3,3,2),1)=B$ AND
RIGHT$(C(3,2,1),1)=B$ AND RIGHT$(C(3,2,3),1)=B$ THEN 8200
' PATTERN 2
8020 IF LEFT$(C(3,2,1),1)=B$ AND LEFT$(C(3,3,2),1)=B$ AND
MID$(C(3,1,2),2,1)=B$ AND RIGHT$(C(3,2,3),1)=B$ THEN 8300
' PATTERN 3
8030 IF LEFT$(C(3,2,1),1)=B$ AND LEFT$(C(3,3,2),1)=B$ AND
LEFT$(C(3,2,3),1)=B$ AND LEFT$(C(3,1,2),1)=B$ THEN 8400
' FINISHED!!
8050 N$="H": M$="0": GOSUB 3049: GOSUB 10000: GOTO 8005
8100 Z$="4.605050406.20204.6050406.20204.605050406.2": FOR

```



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II=1 TO 43 STEP 2: NS=LEFT$(MID$(Z$,II,2),1):
MS=RIGHT$(MID$(Z$,II,2),1): GOSUB 3049: GOSUB 10000:
NEXT II: GOTO 8005
8200 Z$="4.6050406.204.6050406.204.6050406.204.6050406.
204.6050406.2020": FOR II=1 TO 63 STEP 2:
NS=LEFT$(MID$(Z$,II,2),1): MS=RIGHT$(MID$(Z$,II,2),1):
GOSUB 3049: GOSUB 10000:NEXT: GOTO 8005
8300 Z$="4.6050406.2.4.605.406.2.4.605050406.4.6050406.
20204.60504 06.":FOR II=1 TO 59 STEP 2:
NS=LEFT$(MID$(Z$,II,2),1): MS=RIGHT$(MID$(Z$,II,2),1):
GOSUB 3049: GOSUB 10000: NEXT: GOTO 7000
8400 PRINT @ 960,STRING$(26,32);:Q$=" FINISHED
!!!!!!!!!!!!!!": FOR II=1 TO LEN(Q$): PRINT @
958+II*2,MID$(Q$,II,1);: FOR XX=1 TO 100: NEXT XX: NEXT II:
GOTO 8400
9900 REM ***** FIND A CUBE, RETURN LOCATION AS X,Y,Z
*****
9905 F1$=P1$+P2$+P3$: F2$=P1$+P3$+P2$: F3$=P2$+P1$+P3$:
F4$=P2$+P3$+P1$: F5$=P3$+P1$+P2$: F6$=P3$+P2$+P1$
9910 FOR X=1 TO 3:FOR Y=1 TO 3: FOR Z=1 TO 3
9915 C$=C(X,Y,Z)
9920 IF C$=F1$ OR C$=F2$ OR C$=F3$ OR C$=F4$ OR C$=F5$ OR
C$=F6$ THEN 9940
9925 NEXT Z,Y,X
9930 PRINT @960,X,Y,Z;:IF INKEY$="" THEN 9930
9940 RETURN ' REM ***** CUBE IS AT X,Y,Z
10000 REM ***** PRINT CUBE *****
10010 PRINT CHR$(23);
10020 PRINT@ 64,;
10030 V=1:W=1
10040 FOR D=3 TO 1 STEP-1
10050 PRINT@272-64*D,;
10060 FOR H=1 TO 3
10070 GOSUB 10500
10080 NEXT H,D
10090 FOR V=1 TO 3
10100 PRINT@258+64*V,;
10110 H=1:W=2
10120 FOR D=3 TO 1 STEP-1
10130 GOSUB 10500
10140 NEXT D
10150 PRINT@272+64*V,;
10160 D=1:W=3
10170 FOR H=1 TO 3
10180 GOSUB 10500
10190 NEXT H
10200 PRINT@288+64*V,;
10210 H=3:W=2
10220 FOR D=1 TO 3
10230 GOSUB 10500
10240 NEXT D
10250 PRINT@304+64*V,;
10260 D=3:W=3
10270 FOR H=3 TO 1 STEP-1
10280 GOSUB 10500
10290 NEXT H
10300 NEXT V
10310 V=3:W=1
10320 FOR D=1 TO 3
10330 PRINT@528+64*D,;
10340 FOR H=1 TO 3
10350 GOSUB 10500
10360 NEXT H,D
10370 REM FRAME
10380 IF POINT(1,12)=-1 THEN 10495

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continued on page 60

ASTRONOMY SIMULATOR \$39.50 (postpaid)

The Simulator is now being sold to schools around the country. The program lets stars and planets be created. The created objects then move according to the laws of nature.

A universe of millions of galaxies can be explored. Each galaxy can be magnified to reveal millions of stars. Finally, each star system can be explored to see up to 3 suns and up to 3 planets moving in their orbits.

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The program is easy to use. Instructions appear on the screen as needed. A manual of 23 projects is included. The program runs on any 16K, Level II, Model I or III computer with or without a disk. The program comes on a cassette, but is easy to put on a disk.

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RUBIK'S CUBE

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10390 PRINT@164,"RUBIK'S CUBE";: PRINT@16,STRING$(8,131);:
PRINT@258,STRING$(30,131);: PRINT@514,STRING$(30,131);:
PRINT@784,STRING$(8,131);
10400 FOR Y=12 TO 24:SET(1,Y):SET(93,Y):SET(124,Y):NEXT
10410 FOR Y=0 TO 36:SET(29,Y):SET(61,Y):NEXT
10495 IF ZFLAG=1 THEN IF INKEY$="" THEN 10495
10499 RETURN
10500 PRINT " ";MID$(C(V,H,D),W,1);: RETURN
10999 REM *** END OF PRINT ***
14000 REM ***** MOVES *****
14010 V=1: PRINT@ 960,"TOP CLOCKWISE";: GOSUB 17000: RETURN
'REM 80 OK
14020 V=3: PRINT@ 960,"BOTTOM CLOCKWISE";: GOSUB 17050:
RETURN 'REM 20 OK
14030 H=1: PRINT@960,"LEFT COUNTER CLOCKWISE";: GOSUB 15000:
RETURN 'REM 4. OK
14040 H=1: PRINT@ 960,"LEFT CLOCKWISE";: GOSUB 15050: RETURN
'REM 40 OK
14050 H=3: PRINT@ 960,"RIGHT CLOCKWISE";: GOSUB 15000: RETURN
'REM 60 OK
14060 H=3: PRINT@960,"RIGHT COUNTER CLOCKWISE";: GOSUB 15050:
RETURN 'REM 6. OK
14070 D=1: PRINT@ 960,"FRONT CLOCKWISE";: GOSUB 16000: RETURN
'REM 50 OK
14080 D=1: PRINT@ 960,"FRONT COUNTER CLOCKWISE";: GOSUB
16050: RETURN 'REM 5. OK
14090 V=1: PRINT@ 960,"TOP COUNTER CLOCKWISE";: GOSUB 17050:
RETURN 'REM 8. OK
14100 V=3: PRINT@960,"BOTTOM COUNTER CLOCKWISE";: GOSUB
17000: RETURN 'REM 2.
14110 FOR H=1 TO 3: PRINT@960,"LONGITUDINALLY COUNTER ";:
GOSUB 15050:NEXT: RETURN 'REM L.
14120 FOR H=1 TO 3: PRINT@960,"LONGITUDINALLY CLOCKWISE";:
GOSUB 15000:NEXT: RETURN 'REM L0
14130 FOR V=1 TO 3: PRINT@960,"HORIZONALLY CLOCKWISE";: GOSUB
17000: NEXT: RETURN 'REM H0
14140 FOR V=1 TO 3: PRINT@960,"HORIZONTALLY COUNTER
CLOCKWISE";: GOSUB 17050: NEXT: RETURN 'REM H.
14150 FOR D=1 TO 3: PRINT@ 960,"TRANSVERSELY CLOCKWISE";:
GOSUB 16000: NEXT: RETURN 'REM T0 T0
14160 FOR D=1 TO 3: PRINT@ 960,"TRANSVERSELY COUNTER
CLOCKWISE";: GOSUB 16050: NEXT: RETURN 'REM T.
14999 REM *** END OF MOVES ***
15000 REM *****SUBROUTINES USED BY MOVES*****
15010 REM #### ROTATE LONGITUDINALLY FRONT TO BACK #####
15020 T=C(1,H,3): TT=C(1,H,2): C(1,H,3)=C(1,H,1):
C(1,H,2)=C(2,H,1)
15030 C(1,H,1)=C(3,H,1): C(2,H,1)=C(3,H,2): C(3,H,1)=
C(3,H,3): C(3,H,2)=C(2,H,3): C(3,H,3)=T: C(2,H,3)=TT
15040 GOSUB 15100
15045 RETURN ' REM END OF RL F TO B
15050 REM #### ROTATE LONGITUDINALLY BACK TO FRONT ####
15060 T=C(1, H,1): TT=C(1,H,2): C(1,H,1)=C(1,H,3):
C(1,H,2)=C(2,H,3): C(1,H,3) =C(3,H,3): C(2,H,3)=C(3,H,2):
C(3,H,3)=C(3,H,1): C(3,H,2)=C(2,H,1): C(3,H,1)=T: C(2,H,1)=TT
15070 GOSUB 15100
15080 RETURN' REM END OF RL B TO F
15100 REM %%% EXCHANGE LONGITUDINALLY %%%
15110 FOR V=1 TO 3: FOR D=1 TO 3: C(V,H,D)=MID$(C(V,H,D),3,1)
+ MID$(C(V,H,D),2,1) + MID$(C(V,H,D),1,1): NEXT D,V
15120 RETURN ' REM END OF EL
16000 REM
16010 REM #### ROTATE TRANSVERSELY CLOCKWISE ####
16020 T=C(1,3,D): TT=C(1,2,D): C(1,3,D)=C(1,1,D):
C(1,2,D)=C(2,1,D): C(1,1,D)=C(3,1,D): C(2,1,D)=C(3,2,D):

```

```

C(3,1,D)=C(3,3,D): C(3,2,D)= C(2,3,D):C(3,3,D)=T:C(2,3,D)=TT
16030 GOSUB 16100
16040 RETURN ' REM END OF T CW
16050 REM #### ROTATE TRANSVERSELY COUNTERCLOCKWISE ####
16060 T=C(1,1,D): TT=C(1,2,D): C(1,1,D)=C(1,3,D):
C(1,2,D)=C(2,3,D): C(1,3,D)=C(3,3,D): C(2,3,D)=C(3,2,D):
C(3,3,D)=C(3,1,D): C(3,2,D)= C(2,1,D): C(3,1,D)=T:
C(2,1,D)=TT
16070 GOSUB 16100
16080 RETURN ' REM END OF T CCW
16100 REM %%% EXCHANGE TRANSVERSELY %%%
16110 FOR V=1 TO 3: FOR H=1 TO 3: C(V,H,D)=MID$(C(V,H,D),2,1)
+ MID$(C(V,H,D),1,1) + MID$(C(V,H,D),3,1): NEXT H,V
16120 RETURN ' REM END OF ET
17000 REM #### ROTATE HORIZONTALLY LEFT ####
17010 T=C(V,1,1): TT=C(V,2,1): C(V,1,1)=C(V,3,1):
C(V,2,1)=C(V,3,2): C(V,3,1)=C(V,3,3): C(V,3,2)=C(V,2,3):
C(V,3,3)=C(V,1,3): C(V,2,3)= C(V,1,2): C(V,1,3)=T:
C(V,1,2)=TT
17020 GOSUB 17100
17030 RETURN ' REM END OF RHL
17050 REM #### ROTATE HORIZONTALLY RIGHT ####
17060 T=C(V,1,1): TT=C(V,1,2): C(V,1,1)=C(V,1,3):
C(V,1,2)=C(V,2,3): C(V,1,3)=C(V,3,3): C(V,2,3)=C(V,3,2):
C(V,3,3)=C(V,3,1): C(V,3,2)= C(V,2,1): C(V,3,1)=T:
C(V,2,1)=TT
17070 GOSUB 17100
17080 RETURN ' REM END OF RHR
17100 REM %%% EXCHANGE HORIZONTALLY %%%
17110 FOR D=1 TO 3: FOR H=1 TO 3: C(V,H,D)=MID$(C(V,H,D),1,1)
+ MID$(C(V,H,D),3,1) + MID$(C(V,H,D),2,1): NEXT H,D
17120 RETURN ' REM END OF EH
17999 REM *** END OF SUBROUTINES USED BY MOVES ***

```

INTERVAL

This program will tell you your dates or ownership for weekly interval ownership of condominiums or other "time-shared" facilities.

```

0 CLS: PRINT"INTERVAL OWNERSHIP: ":PRINT TAB(1),"WEEKS BEGIN
WITH FIRST SATURDAY OF THE YEAR"
1 US$="" % ### % % ### ":U1$="" % % ##"
2 CR=0
5 PRINT@ 7*64,"BY WILLIAM H. PATRICK":PRINT "RT7 PARADISE
CAMP ROAD": PRINT "HARRODSBURG, KENTUCKY 40330"
10 PRINT: INPUT "DESIRED YEAR (1981 TO 2099)":DY
20 IF DY<1981 OR DY>2099 THEN 10
30 AD=DY-1980
40 IF DY/4=INT(DY/4) THEN 60
50 AD=AD+INT(AD/4)
60 AD=AD+4
70 R=AD-INT(AD/7)*7 'R IS NUMBER OF DAY OF WEEK YEAR BEGINS
ON
80 W=1
90 IF R=0 THEN ST=1 ELSE ST=8-R
100 READ M$,M
105 IF DY/4=INT(DY/4) AND M$="FEBRUARY" AND CR=0 THEN M=M+1
:CR=1
110 PRINT USING US$;"WEEK",W,M$,ST;
120 ED=ST+7
130 IF ED<=M THEN 200
140 ED=ED-M
150 READ M$,M
200 PRINT USING U1$;M$,ED
210 ST=ED
220 W=W+1
230 IF W>52 THEN 1000
240 GOTO 105

```

William H. Patrick
Rte 7, Paradise Camp Rd.
Harrodsburg, KY 40330 ■

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solely for his personal use. The inclusion of the user's name and address when first running the program is undoubtedly an effective deterrent to piracy.

Certainly the most significant feature of these cassette operating systems is the KWIK storage format. Programs stored in the manner are saved at 2200 baud on the Model III (almost a 50% improvement over 1500 baud) and from 2 times to 6 times faster on the Model I. Loading time saved becomes more dramatic as program length increases, as 20 seconds of "gear shifting" is required to achieve the maximum 3000 baud. Typically, a 4-minute Model I program would load in 56 seconds under the KWIK format.

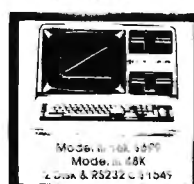
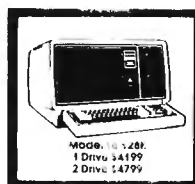
The KWIK storage procedure includes an enhanced verification process. Even if no speed were gained, KOS3 would be worth \$26 for this feature alone.

A number of features are available in both KWICOS and KOS3 which simulate a disk operating system. Programs saved on cassette may be given passwords and even comments, and a "directory", including program lengths, may be obtained. In addition, graphics are used to indicate what process is occurring at any given time. Even error messages are improved, such as "RECORDER NOT READY."

A keyboard debounce feature and a variable-speed LIST command are available. In addition, KOS3 (Model III) adds a simple command to deactivate the BREAK key, simplified I/O routing (easily route your printer output to RS-232, for example), a command to display the real-time clock, and provisions for maintaining the current date.

It is possible to continue reciting commands, features, and praise of both the Lemons Tech loaders and the KWIK Software cassette operating system. However, I feel that the information presented here speaks for itself. For \$43.95 complete (\$26 for KOS3 or KWICOS + \$17.99 for a loader), this combination of hardware and software is *the* mass storage answer for the computerist on a budget. If you are still using a cassette system and do not plan to expand in the near future, there is *no* excuse not to purchase these products.

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Model: III 6332 C	1549	2 Disk & 6332 C	535				
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COMPUTRONICS Issue #48 (August 1982) program diskette contains the following programs: Information Retrieval System, including KW, Sort, Merge, and List; the Transportation method of linear programming; the Beale Treasure, including Filer, Write1, Write2, Write3, Process/Let, Process/L1, and Process/L2; and the Versatile Peeker.

COMPUTRONICS Issue #49 (September 1982) program diskette contains the following programs: the Simplex method of linear programming; Records and Files, including Schedule, Schedule/Sub, Schedule/Seq, Schedule/Ran; Monthly Expenditure Information package, including Update, Mstex, Monthre, and Report; and Scramble.

COMPUTRONICS Issue #50 (October 1982) program diskette contains the following programs: Cash flow analysis for real estate and other investments; Epson MX-80 Graftrax Initialization program; Kaleidoscope, Gascost, Permile, and Balloon by Gordon Speer.

COMPUTRONICS Issue #51 (November 1982) program diskette contains the following programs: the Cardwriter,

the Graphical Method of Linear Programming, MACSMAP, and Phone bill sorting program.

COMPUTRONICS Issue #52 (December 1982) program diskette contains the following programs: Regression Analysis with Confidence and Prediction Limits, Change baud rates on system tapes, PERT—Program Evaluation and Review Technique, Grid, and Monogram.

COMPUTRONICS Issue #53 (January 1983) program diskette contains the following programs: General Ledger Menu, Alpha Program, Roulette, Serious EDTASM, Surname Conversion, Jack and Jill, and Disk Checkbook Maintenance System.

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continued from page 61

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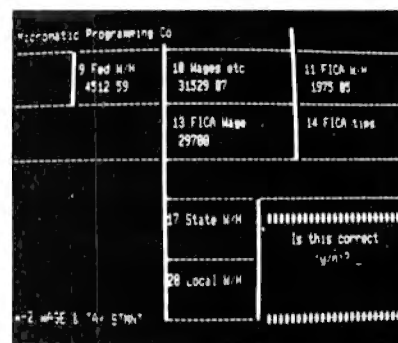
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2 ANNU1	Annuity computation program
3 DATE	Time between dates
4 DAYYEAR	Day of year a particular date falls on
5 LEASEINT	Interest rate on lease
6 BREAKVEN	Breakeven analysis
7 DEPRSL	Straightline depreciation
8 DEPRSY	Sum of the digits depreciation
9 DEPRDB	Declining balance depreciation
10 DEPRDDB	Double declining balance depreciation
11 TAXDEP	Cash flow vs. depreciation tables
12 CHECK2	Prints NEBS checks along with daily register
13 CHECKBK1	Checkbook maintenance program
14 MORTGAGE/A	Mortgage amortization table
15 MULTMON	Computes time needed for money to double, triple, etc.
16 SALVAGE	Determines salvage value of an investment
17 RRVARIN	Rate of return on investment with variable inflows
18 RRCONST	Rate of return on investment with constant inflows
19 EFFECT	Effective interest rate of a loan
20 FVAL	Future value of an investment (compound interest)
21 PVAL	Present value of a future amount
22 LOANPAY	Amount of payment on a loan
23 REGWITH	Equal withdrawals from investment to leave 0 over
24 SIMPDISK	Simple discount analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.
26 ANNUDEF	Present value of deferred annuities
27 MARKUP	% Markup analysis for items
28 SINKFUND	Sinking fund amortization program
29 BONDVAL	Value of a bond
30 DEplete	Depletion analysis
31 BLACKSH	Black Scholes options analysis
32 STOCVAL1	Expected return on stock via discounts dividends
33 WARVAL	Value of a warrant
34 BONDVAL2	Value of a bond
35 EPSEST	Estimate of future earnings per share for company
36 BETAALPH	Computes alpha and beta variables for stock
37 SHARPE1	Portfolio selection model-i.e. what stocks to hold
38 OPTWRITE	Option writing computations
39 RTVAL	Value of a right
40 EXPVAL	Expected value analysis
41 BAYES	Bayesian decisions
42 VALPRINF	Value of perfect information
43 VALADINF	Value of additional information
44 UTILITY	Derives utility function
45 SIMPLEX	Linear programming solution by simplex method
46 TRANS	Transportation method for linear programming
47 EOQ	Economic order quantity inventory model
48 QUEUE1	Single server queueing (waiting line) model
49 CVP	Cost-volume-profit analysis
50 CONDPFOT	Conditional profit tables
51 OPTLOSS	Opportunity loss tables
52 FQOQ	Fixed quantity economic order quantity model
53 FQEOQWSH	As above but with shortages permitted
54 FQEOQPB	As above but with quantity price breaks
55 FQEOQCB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability index of a project
58 CAP1	Cap. Asset Pr. Model analysis of project

59 WACC	Weighted average cost of capital
60 COMBAL	True rate on loan with compensating bal. required
61 DISCBAL	True rate on discounted loan
62 MERGANA1	Merger analysis computations
63 FINRAT	Financial ratios for a firm
64 NPV	Net present value of project
65 PRINDLAS	Laspeyres price index
66 PRINDPA	Paasche price index
67 SEASIND	Constructs seasonal quantity indices for company
68 TIMETR	Time series analysis linear trend
69 TIMEMOV	Time series analysis moving average trend
70 FUPTINF	Future price estimation with inflation
71 MAILPAC	Mailing list system
72 LETWRT	Letter writing system-links with MAILPAC
73 SORT3	Sorts list of names
74 LABEL1	Shipping label maker
75 LABEL2	Name label maker
76 BUSBUD	DOE business bookkeeping system
77 TIMECLCK	Computes weeks total hours from timeclock info.
78 ACCTPAY	In memory accounts payable system-storage permitted
79 INVOICE	Generate invoice on screen and print on printer
80 INVENT2	In memory inventory control system
81 TELDIR	Computerized telephone directory
82 TIMUSAN	Time use analysis
83 ASSIGN	Use of assignment algorithm for optimal job assign.
84 ACCTREC	In memory accounts receivable system-storage ok
85 TERMPAY	Compares 3 methods of repayment of loans
86 PAYNET	Computes gross pay required for given net
87 SELLPR	Computes selling price for given after tax amount
88 ARBCOMP	Arbitrage computations
89 DEPRSF	Sinking fund depreciation
90 UPSZONE	Finds UPS zones from zip code
91 ENVELOPE	Types envelope including return address
92 AUTOEXP	Automobile expense analysis
93 INSFILE	Insurance policy file
94 PAYROLL2	In memory payroll system
95 DILANAL	Dilution analysis
96 LOANAFDD	Loan amount a borrower can afford
97 RENTPRCH	Purchase price for rental property
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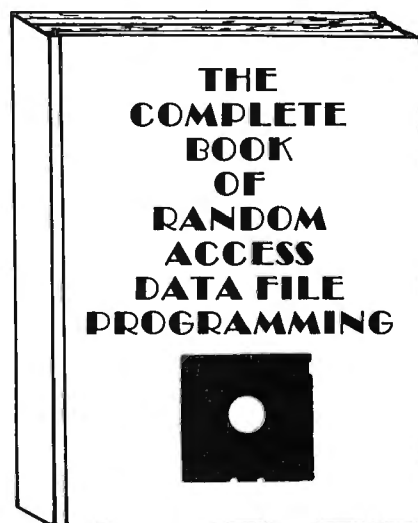
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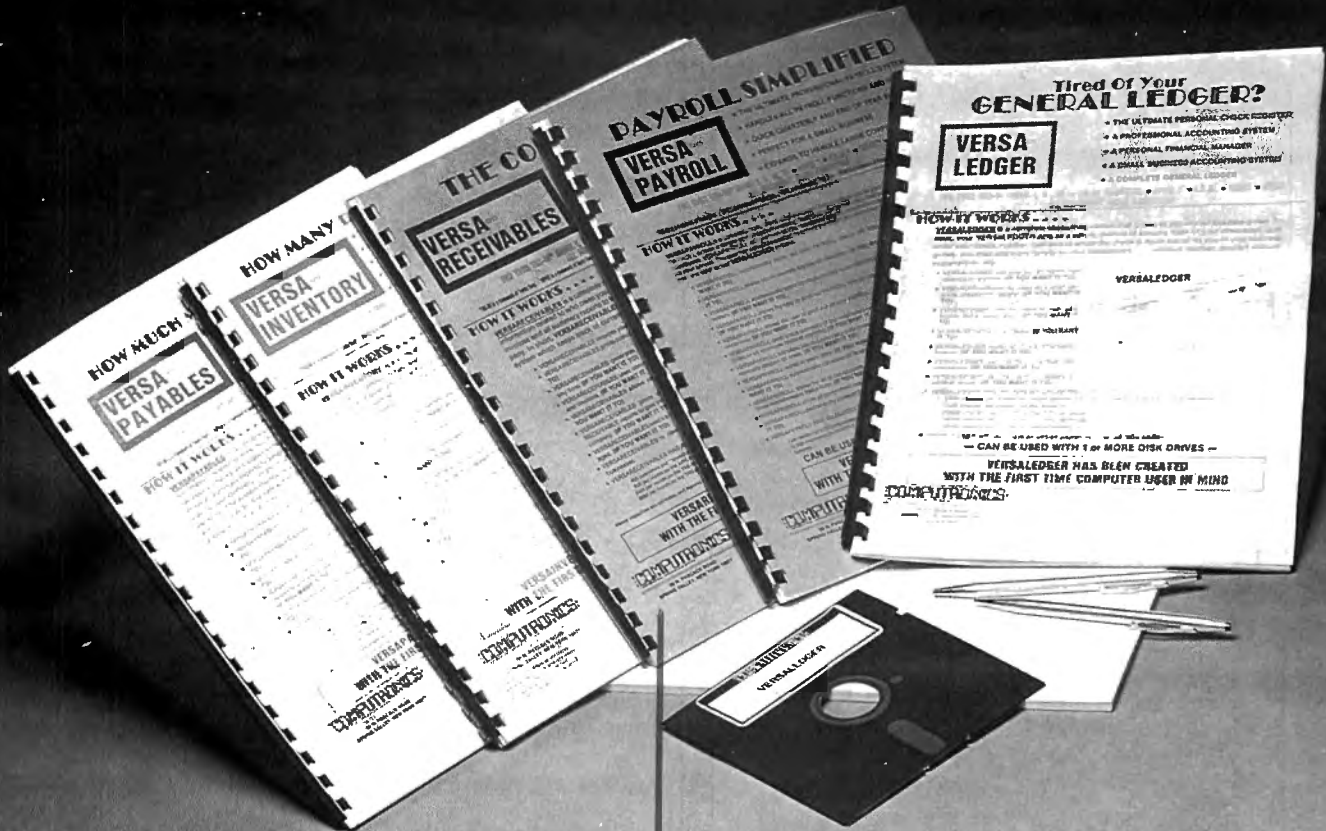
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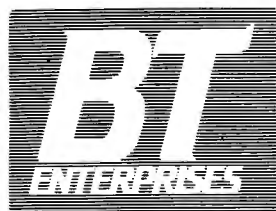
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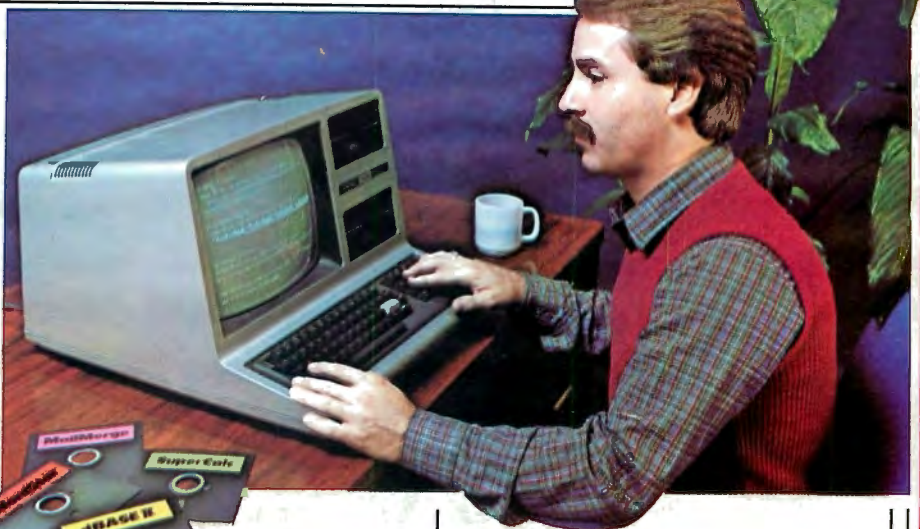
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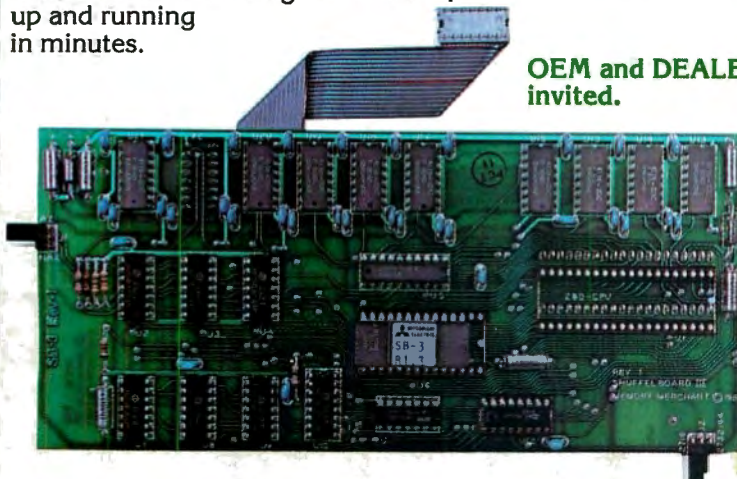
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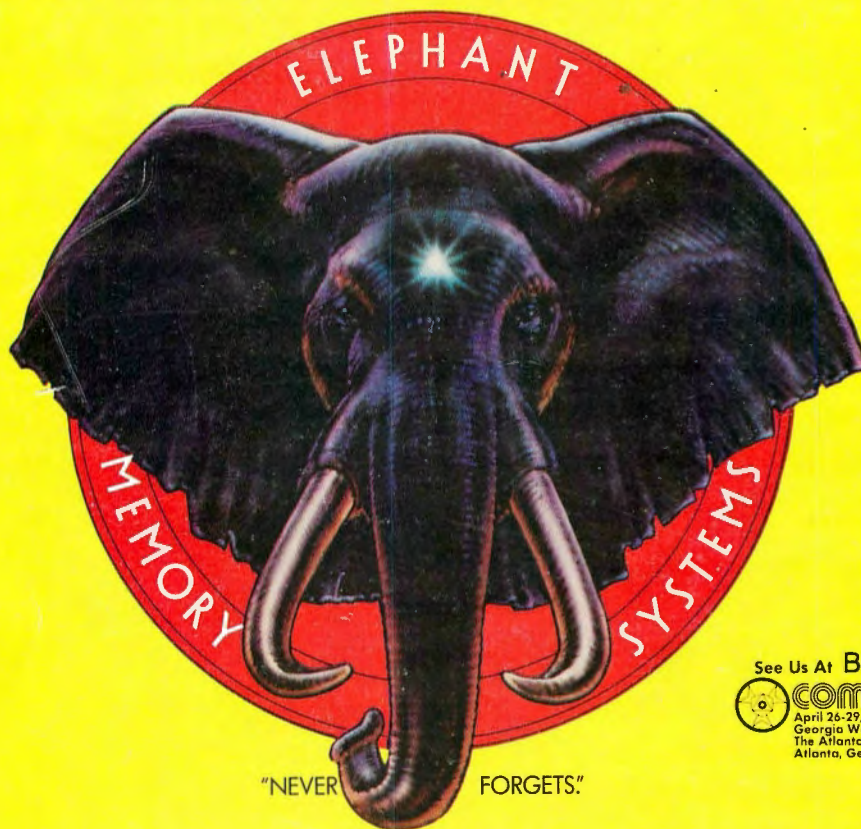
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